

**CAREGIVER MENTAL HEALTH AND CHILD PHYSICAL  
HEALTH IN HIV-AFFECTED FAMILIES IN UGANDA**

by

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## **Abstract**

**Background:** Increasing evidence from low- and middle-income countries indicates that maternal depression is associated with poor child health and growth. Few studies have explored this relationship in the context of HIV. This dissertation investigated the relationship between caregiver mental health and child physical health among women and their HIV-infected children in rural Uganda. Specifically, we examined the longitudinal impact of caregiver depression and anxiety on child growth and potential reciprocal impacts of child growth on caregiver mental health. Caregivers' own understandings of this relationship were also explored qualitatively.

**Methods:** Data was collected over two years from 60 caregiver-child dyads randomized to the treatment as usual control arm (a general health training program) in a trial of a parenting intervention. Caregiver mental health was assessed using the 25-item Hopkins Symptom Checklist (HSCL-25), which includes separate scales for depression and anxiety. Child growth was operationalized as height for age (HAZ) and weight for age (WAZ) z-scores. Quantitative data were analyzed using mixed-effects regression and structural equation modeling. Qualitative data were collected from a purposive subsample of caregivers (n=9) and their health trainers (n=4) in 20 semi-structured interviews. Thematic analysis generated a conceptual framework of the relationship between caregiver mental health and child well-being.

**Results:** In mixed-effects regressions, worsening caregiver depression and anxiety resulted in minimal and non-significant changes in child HAZ ( $\beta = -0.01$ , 95% CI: -0.27, 0.25) and WAZ ( $\beta = 0.13$ , 95% CI: -0.17, 0.43). Compared to episodic or consistently low

symptoms, chronic symptoms exhibited a non-significant dose response relationship with poorer child growth. In cross-lagged panel analyses, caregiver distress predicted lower WAZ (12-months:  $\beta=-0.142$ ,  $p\text{-value}=0.011$ ; 24-months:  $\beta=-0.171$ ,  $p\text{-value}=0.010$ ) but not HAZ. Child growth (HAZ:  $\beta=-0.275$ ,  $p\text{-value}=0.004$ ; WAZ:  $\beta=-0.275$ ,  $p\text{-value}=0.008$ ) predicted caregiver distress at 24-months. From the qualitative study, caregivers described their mental health as primarily affecting children emotionally and behaviorally. They also discussed how being unable to provide or care for their children brought them distress, particularly when children were sick.

**Conclusions:** A potentially bidirectional relationship between caregiver mental health and child growth indicates a need to provide multifaceted and integrated mental and physical health services to HIV-affected families.

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## Table of Contents

<b>Abstract.....</b>	<b>ii</b>
<b>Acknowledgements .....</b>	<b>v</b>
<b>List of Tables .....</b>	<b>xi</b>
<b>List of Figures.....</b>	<b>xii</b>
<b>Chapter 1. Introduction .....</b>	<b>1</b>
<b>1.1 Statement of the problem.....</b>	<b>1</b>
1.1.1 Depression and anxiety among women in the context of HIV .....	1
1.1.2 Intergenerational impact of maternal mental health.....	2
1.1.3 Maternal mental health and child physical health in HIV-affected families.....	4
1.1.4 Health significance of maternal mental health problems and HIV for children.....	5
<b>1.2 Specific aims.....</b>	<b>6</b>
<b>1.3 Organization of the dissertation.....</b>	<b>8</b>
<b>1.4 References .....</b>	<b>11</b>
<b>Chapter 2. Conceptual framework and study context .....</b>	<b>21</b>
<b>2.1 Conceptual framework.....</b>	<b>21</b>
2.1.1 Health behavior perspective .....	21
2.1.2 Attachment theory .....	22
2.1.3 Social cognitive theory.....	23
2.1.4 Therapeutic citizenship .....	25
<b>2.2 The Ugandan context.....</b>	<b>26</b>
2.2.1 Political history .....	26
2.2.2 Language and ethnicity .....	28
2.2.3 HIV/AIDS in Uganda.....	28
2.2.4 Mental health in Uganda .....	31
<b>2.3 References .....</b>	<b>35</b>
<b>Chapter 3. Methods .....</b>	<b>44</b>
<b>3.1 Data source.....</b>	<b>44</b>
3.1.1 Trial overview .....	44
3.1.2 Sampling .....	45
3.1.3 Intervention in the treatment as usual (TAU) control arm .....	46
<b>3.2 Mixed methods typology .....</b>	<b>47</b>
3.2.1 Epistemology.....	48
3.2.2 Mixed methods design .....	50
<b>3.3 Methods .....</b>	<b>50</b>
3.3.1 Aim 1: Mixed-effects regression.....	50
3.3.2 Aim 2: Qualitative data collection and analysis.....	54
3.3.3 Aim 3: Structural equation modeling .....	59
3.3.4 Ethical considerations and approval.....	63
<b>3.4 References .....</b>	<b>65</b>
<b>Chapter 4: A longitudinal investigation of the impact of caregiver mental health on child growth and HIV-illness in Uganda .....</b>	<b>69</b>
<b>4.1 Abstract .....</b>	<b>69</b>



<b>4.2 Introduction .....</b>	<b>70</b>
4.2.1 Intergenerational impact of maternal depression and anxiety .....	70
4.2.2 Gaps in current research .....	71
4.2.3 Maternal mental health and child physical well-being in HIV-affected families.....	72
4.2.4 Study aims .....	73
<b>4.3 Methods .....</b>	<b>74</b>
4.3.1 Study design and participants.....	74
4.3.2 Measures .....	75
4.3.3 Analysis.....	78
<b>4.4 Results.....</b>	<b>80</b>
4.4.1 Caregiver and child characteristics .....	80
4.4.2 Regression analyses.....	81
<b>4.5 Discussion .....</b>	<b>87</b>
<b>4.6 Conclusions .....</b>	<b>90</b>
<b>4.7 References .....</b>	<b>92</b>
 <b>Chapter 5: Caregiver understandings of their mental health and child-wellness: a qualitative investigation among HIV-affected families in Uganda .....</b>	 <b>101</b>
<b>5.1 Abstract .....</b>	<b>101</b>
<b>5.2 Introduction .....</b>	<b>102</b>
<b>5.3 Methods .....</b>	<b>103</b>
5.3.1 Participants and eligibility.....	103
5.3.2 Procedures .....	105
5.3.3 Ethics.....	105
5.3.4 Data analysis .....	106
<b>5.4 Results.....</b>	<b>106</b>
5.4.1 “You have to struggle to survive.” Fulfilling the role of caregiver .....	107
5.4.2 “They also suffer.” Caregiver understandings of how their mental health affects children.....	108
5.4.3 “When the child is sick, it’s like you are the one who is sick.” How child sickness affects caregivers’ lives.....	109
5.4.4 “Asking yourself many questions without answers.” Mental health and the inability to provide.....	110
5.4.5 “I’m just alone as you see me.” The duality of support and isolation.....	113
<b>5.5 Discussion .....</b>	<b>116</b>
<b>5.6 Conclusions .....</b>	<b>119</b>
<b>5.7 References .....</b>	<b>120</b>
 <b>Chapter 6. The interrelationship between caregiver mental health and the growth of HIV-infected children in Uganda: a cross-lagged panel analysis.....</b>	 <b>127</b>
<b>6.1 Abstract .....</b>	<b>127</b>
<b>6.2 Introduction .....</b>	<b>128</b>
<b>6.3 Methods .....</b>	<b>130</b>
6.3.1 Study design and participants.....	130
6.3.2 Measures .....	131
6.3.3 Analysis.....	132
<b>6.4 Results.....</b>	<b>135</b>
6.4.1 Descriptive statistics.....	135
6.4.2 HAZ.....	136
6.4.3 WAZ.....	137

6.5 Discussion .....	138
6.6 Conclusions .....	140
6.7 References .....	147
<b>Chapter 7. Discussion .....</b>	<b>157</b>
7.1 Summary of findings .....	158
7.2 Limitations .....	161
7.3 Directions for future research .....	162
7.4 Implications for public health policy and practice .....	165
7.5 References .....	168
<b>Curriculum Vitae .....</b>	<b>173</b>

## List of Tables

### Chapter 4

**Table 4.1** Caregiver and child characteristics at baseline ..... p. 95

**Table 4.2** Association of average caregiver HSCL symptom scores with child growth and HIV-illness severity ..... p. 97

**Table 4.3** Association of chronicity of caregiver HSCL symptoms with child growth and HIV-illness severity at 24-months ..... p. 98

### Chapter 6

**Table 6.1:** Hopkins Symptom Checklist-25 (HSCL-25) measurement model development ..... p. 154

**Table 6.2:** Descriptive statistics of caregiver mental health and child physical health over 2-years of follow-up ..... p. 156

**Table 6.3** Goodness of fit indices for models with height for age (HAZ) and weight for age (WAZ) z-scores ..... p. 156

## List of Figures

### Chapter 1

**Figure 1.1** Dissertation aims ..... p. 20

### Chapter 3

**Figure 3.1** Data collection timeline ..... p. 57

**Figure 3.2** Mixed methods research design..... p. 62

### Chapter 4

**Figure 4.1** Participant screening and follow-up..... p. 103

### Chapter 5

**Figure 5.1** The relationship between maternal mental health and child well-being described by caregivers ..... p. 127

### Chapter 6

**Figure 6.1:** Interrelationship between caregiver mental health and child height for age z-score (HAZ) over two-years ..... p. 157

**Figure 6.2:** Interrelationship between caregiver mental health and child weight for age z-score (WAZ) over two-years..... p. 158

## **Chapter 1. Introduction**

### **1.1 Statement of the problem**

#### *1.1.1 Depression and anxiety among women in the context of HIV*

Publication of the 1990 Global Burden of Disease (GBD) study by the World Health Organization (WHO) and the World Bank illuminated the substantial impact of neuropsychiatric conditions on morbidity worldwide (1). In 2001, the GBD study attributed 37% of years lost to disability (YLDs) in adults to neuropsychiatric conditions, including unipolar depression and anxiety disorders (1). In the 2004 GBD update, depression was found to contribute more to disability in low-income countries than any other non-communicable or childbirth-related condition (2), yet many low and middle-income countries allocate under 1% of their health budget to mental health (3).

Lifetime history of depression has been demonstrated to be roughly twice as common in women across diverse cultures (4). Maternal depression in particular is common in low-resource settings, where known risk factors of low educational attainment and poverty are widespread (5). A perinatal depression prevalence of 15-25% has been identified in multiple low-resource settings globally (6–9). Although less studied, anxiety is also common in mothers in LMIC; a recent review identified only two studies of postnatal anxiety among women in Africa and an average prevalence of 14% (9).

Though common in the general population, the prevalence of depression and anxiety has been demonstrated to be significantly greater in people living with

HIV/AIDS (PLWHA) (10–12) and among those with symptomatic as compared to asymptomatic HIV infection (13). Prevalence estimates of depression among PLWHA in LMIC range from 30-40% (11,14). In Uganda, where this study takes place, the prevalence of depression among PLWHA has been estimated to range from 8.1% to 47% (12,15–20) (variation in estimates is likely due to differences in the instrument used, whether or not the instrument was locally adapted and validated, and region).

A study of depression among HIV/AIDS patients in eastern Uganda, which included Tororo and Busia districts, estimated 47% depression prevalence using the Center for Epidemiological Studies Depression scale (CES-D) with a cut off of 23. This study found that depression was associated with female sex, older age, and having no source of income as well as HIV illness-severity, in particular low CD4 count (17,21). A recent meta-analysis identified that post-delivery depression among women living with HIV was linked to poorer adherence to antiretroviral therapy (ART) (22), demonstrating that depression can have important health consequences for mothers living with HIV.

### *1.1.2 Intergenerational impact of maternal mental health*

Maternal depression can have intergenerational effects (5,23,24). In high-income countries (HIC), maternal depression has been shown to have an adverse impact on child cognitive and emotional development (25–27). Children of depressed mothers in HIC were also shown to have almost five times the odds of developing depression before they reached 16 years of age, possibly due to insecure attachment, less resilience in childhood, and family adversity (28). Both antenatal and postnatal depression appear to

increase the risk of depression in children at age 18 years (29).

The association of maternal depression and child cognitive and emotional development has seldom been studied in LMIC where environmental stressors put children at high risk for cognitive and emotional delays (30–34). A study in South Africa found that children of mothers who experienced depression six months after birth were more likely to exhibit behavioral problems at age 2, and this relationship was mediated by child stunting (35). There is also evidence of adverse effects of postnatal anxiety on child psychological outcomes in HIC (36), though this relationship has not been thoroughly examined in LMIC.

Depression in the antenatal period has been found to be associated with lower birth weight, and in LMIC, the association is two times the magnitude of that found in the U.S. with an estimated risk ratio of 2.05 (95% CI: 1.43-2.93) (37). Depression during this period has also been associated with premature birth in LMIC; in Brazil, depressed pregnant women were 2.32 times as likely (95% CI: 1.18-4.58) to have a preterm birth than non-depressed women (38). In India, women with depression during pregnancy were found to have 3.49 times the risk of intrauterine growth restriction (95% CI: 1.48, 8.23) (7). Though the evidence has not always been consistent, a meta-analysis of 17 studies in LMIC found that children of depressed mothers had greater odds of impairment in physical growth and nutrition than those of non-depressed mothers, placing them at risk of lower educational achievement and disease (24). Specifically, the odds ratio of underweight and stunting in children of depressed versus non-depressed mothers was estimated as 2.2 and 2.0 respectively based on four longitudinal studies (24). Chronic depression has been shown to have a greater impact on child nutrition and

growth than episodic depression in a study from rural Pakistan (39).

Poor maternal mental health has also been linked to a range of child illnesses. Children of depressed mothers in Ghana and Cote D'Ivoire had an adjusted 1.32 times the hazard of developing febrile illness as compared to those of non-depressed mothers (40). Maternal depression has been shown to have an effect on diarrheal illness independent of the effect on birth-weight in children living in South Asia (41). Higher prevalence of diarrheal illness has also been found in children of HIV-infected depressed mothers compared to uninfected or HIV-infected non-depressed mothers (42).

### *1.1.3 Maternal mental health and child physical health in HIV-affected families*

With 16.7 million women living with HIV worldwide (43) and a high prevalence of psychopathology identified among women living with HIV (10,11) and caregivers of HIV-orphans (44), it is especially important to understand the impact of caregiver mental health on child growth and physical development in HIV-affected families. HIV-related illness can threaten family livelihood and exacerbate poverty (45) leading to poorer neurological and immunological development in young children (46).

Poorer child growth and nutrition (including low birth weight, stunting, being underweight, and to a lesser extent wasting) has been shown to be more prevalent in HIV-infected children as compared to uninfected children (47–50). In South Africa, over half of children being treated at a Cape Town clinic were found to be stunted or underweight before going on ART (50). There is evidence that HIV-exposed but uninfected children are also at risk for early growth faltering (48,51). Such growth impairment, specifically lower than expected weight for length, has been found to be



associated with diarrheal and respiratory infections in both HIV-infected and uninfected children exposed in utero (52). Additionally, growth impairment among HIV-exposed children has been shown to confer additional risk for poor neurologic development outcomes (53). While ART has been found to contribute to a beneficial change in the growth trajectory of HIV-infected children (50), children can improve but remain undernourished (47).

#### *1.1.4 Health significance of maternal mental health problems and HIV for children*

Given the increased odds of poor growth in children of depressed mothers and the high global prevalence of maternal depression, the population attributable risk (PAR) of maternal depression on child stunting was estimated in two studies as 22.5 and 29.4% and on underweight as 27.0 and 27.5 % (24). Under-nutrition in mothers and children is estimated to be responsible for 35% of morbidity in children under five and 3.5 million child deaths (55). Under-nutrition in early childhood can have long-term impacts on physical and cognitive development (56), school performance (57), and immune functioning (58). Understanding this relationship and how to intervene to prevent negative intergenerational effects of maternal mental health problems, particularly among HIV-affected families, could make a substantial contribution to improving child health globally.

Despite a 50% stunting and 28% underweight prevalence among children under five in eastern Africa (55), a limited number of studies have longitudinally examined maternal mental health and child growth in Sub-Saharan Africa (35,59–61) and even fewer have explicitly assessed this relationship among children of HIV-positive mothers

(61) making research on this topic in HIV-affected children in Sub-Saharan Africa a public health priority. Further, while early childhood is a critical developmental window, prior studies of the relationship of maternal mental health and child growth and nutrition have focused exclusively on infants (i.e. children under the age of 2) as opposed to including young children through 5 years of age (24). Although growth faltering begins early with malnutrition in utero and in infancy, failures to meet length and height standards continue through a child's third year, and early childhood is a critical time for "catching up" in weight for height (62). Given varying sensitivity and plasticity in developmental course across life stages, it is critical to understand the impact of caregiver mental health beyond infancy throughout early childhood (46).

## 1.2 Specific aims

Given the limitations of the current literature, the goal of this dissertation is to explore the relationship between the mental health of a sample of female caregivers and their HIV-infected children's health. The setting of the current research is rural eastern Uganda. With a 17.8% prevalence of current depression observed in rural Ugandan women living with HIV (16) and more than 50% of HIV-infected children from this area identified as underweight and stunted (63), the proposed research objective is highly relevant to this sample. This study's specific aims are:

**Specific Aim 1:** To longitudinally assess the effect of caregiver mental health (depression and anxiety) on child physical health (growth and HIV-illness) among young (aged 2-5 years) HIV-infected children.

*Hypothesis:* Poorer caregiver mental health over time will predict worse child growth and HIV-illness over two-years of follow-up.

**Specific Aim 2:** To qualitatively explore caregivers' understandings of the relationship between their mental health and their HIV-infected child's physical health and growth.

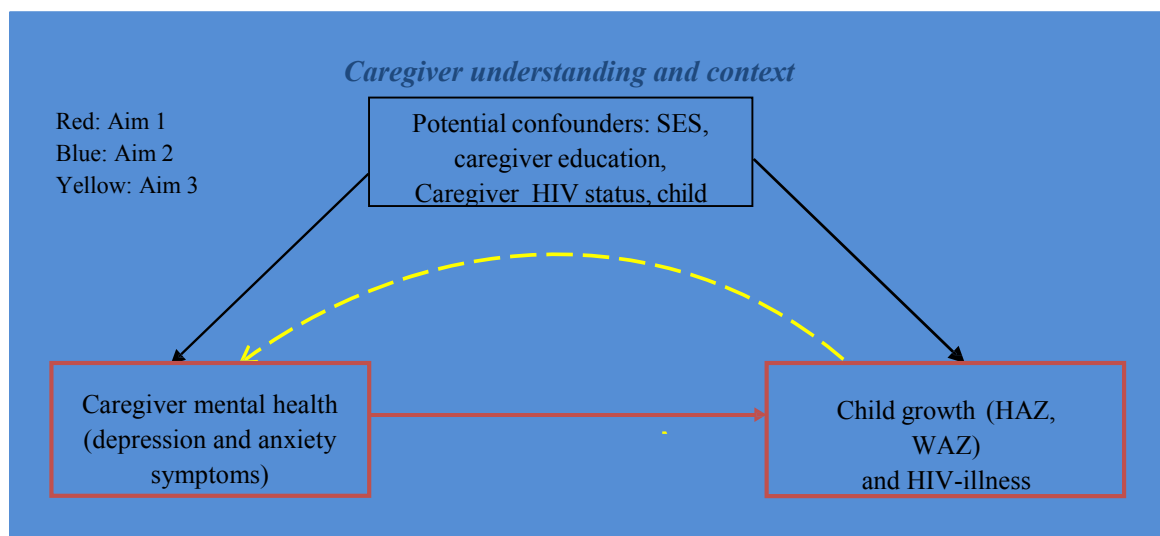
**Specific Aim 3:** To evaluate the reciprocal relationship between caregiver mental health (depression and anxiety) and child growth in HIV-infected children over two years.

*Hypothesis:* Poor child physical health and poor caregiver mental health will each have a negative effect on the other throughout the two-year follow-up period.

### 1.3 Organization of the dissertation

This dissertation consists of three separate analyses on the topic of caregiver mental health and HIV-infected child physical health that correspond to the three specific aims of the dissertation. Figure 1.1 presents a conceptual illustration of the interrelationship of the study's three specific aims. After giving an initial overview of prior literature published on this topic in Chapter 1, the theories and ideas guiding the investigation of all three aims is detailed in Chapter 2 as a conceptual framework. Chapter 2 also provides an orientation to Uganda, the location of this dissertation research, including relevant political, health, and cultural history. Chapter 3 describes the methods used to address all three aims and includes an overview of the parent trial from which the quantitative data used in this dissertation was drawn. Chapters 4-6 present the background, methods, results and discussions corresponding to each of the three dissertation aims.

**Figure 1.1:** Dissertation aims



In chapter 4 (Aim 1), the effect of poor caregiver mental health (depression and anxiety symptoms) on child physical health is examined, with the primary outcome of child growth operationalized as sex and age standardized z-scores for (1) child height for age and (2) child weight for age. The secondary outcome of child HIV-illness progression was operationalized as (1) viral load and (2) CD4 cell count. Data from 60 caregiver-child dyads (children were between the ages of 2-5 years at enrollment) were collected beginning in March 2012 through a 24-month follow-up period ending in November 2013.

Chapter 5 (Aim 2) presents a qualitative study conducted to produce a conceptual framework of the relationship between caregiver mental health and child well-being based on the perspectives of Ugandan caregivers who have experienced elevated depression and anxiety symptoms. A purposive sample of caregivers was interviewed using semi-structured guides. In addition, four trainers who were providing health care training to the study participants were interviewed. This aim was designed to suggest important contextual variables and to generate hypotheses about the nature and mechanisms of the relationship between caregiver mental health and child physical health.

Chapter 6 (Aim 3) presents an analysis of the quantitative data from the 60 caregiver-child dyads informed by the Aim 2 qualitative findings. Reciprocal effects of child growth on caregiver mental health over time were simultaneously modeled. Specifically, the relative influence of both caregiver mental health and child growth on

each other over time was estimated while accounting for the intra-relationships of these variables over the 24-month follow-up period.

In Chapter 7, key findings from all of the three study aims are reviewed and implications for policy and practice are discussed. In addition, important avenues for future study are suggested.

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## **Chapter 2. Conceptual framework and study context**

There are multiple plausible mechanisms by which caregiver mental health may impact child physical health and several theories highlight potential factors affecting this relationship among HIV-affected caregivers in Uganda. Together, these theories and mechanisms aided in the conceptualization of the dissertation aims. In addition, this chapter contains an overview of relevant features of politics, culture, and health in Uganda to elucidate the context in which the dissertation data were collected.

### **2.1 Conceptual framework**

#### *2.1.1 Health behavior perspective*

By taking a health behavior perspective, multiple maternal behaviors that could be relevant to understanding the relationship between maternal mental health and physical health among young children can be identified. Changes in breastfeeding patterns are one potential mechanism of this relationship. Depressed mothers in LMIC have been shown to cease breastfeeding earlier than non-depressed mothers (1,2). Non-exclusive breastfeeding in the first six months of life and early cessation have both been shown to substantially raise the risk of infectious disease and child mortality in LMIC (3). In addition, mastitis and intermittent or mixed breastfeeding have been found to increase the risk of HIV-transmission from mother to child (4,5).

Differences in health-seeking behaviors are another potential mechanism; children of depressed mothers have been shown to be less likely to be fully immunized at one year than those of non-depressed mothers (6). These reductions in health seeking

behaviors may be an indication of increased functional impairment. For PLWHA, reduced functioning can occur due to illness but also mental distress. Reduced ability of a mother to engage in essential caregiving and health prevention practices has been shown to mediate the relationship between maternal depression and child health in high-resource settings (7,8). Maternal functional impairment could also lead to child sickness and undernutrition through poorer water and sanitation related behaviors (9) or increases in harmful practices such as geophagy (10) resulting from reduced child monitoring.

Poor maternal functioning due to HIV-illness can also have socioeconomic consequences that may in turn negatively impact children. HIV/AIDS related-morbidity and mortality has been linked to community and country-level economic decline, and though less studied, to household socioeconomic loss (11). These losses are likely also a product of increased health related expenditures due to worsening HIV-illness (11). Being placed on ART has been shown to improve food security partially through improvements in basic daily functioning (12).

### *2.1.2 Attachment theory*

Caregiver mental health could also impact child physical health through disrupted caregiver-child attachment. With origins in Bowlby's work from the 1930's and 1950's, attachment theory posits that caregivers serve as "secure bases" from which young children can experience and explore the broader world (13). The relative importance of security and comfort in attachment compared to physical needs was demonstrated through Harlow's experiments with macaques, in which infants preferred to seek comfort from a cloth mother over a wire mother that provided milk (14). For secure

attachment to occur, the caregiver must be consistently available and able to provide comfort and support to the child (13).

Caregiver inconsistency, coldness, or inaccessibility can lead to insecure (specifically avoidant, ambivalent, or disorganized) attachment that can in turn affect development and relationship formation throughout the life course (13). Maternal depression has been linked to insecure and disorganized child attachment in high-income contexts (15) and poor attachment predicts morbidity and failure to thrive in children (16). Among the minimal research that can be found in LMIC, the amount of stimulation and support provided to a child in the home was found to be a partial mediator of the relationship between caregiver mental health and child physical well-being in Bangladesh (17). Also in Bangladesh, a separate study found that parental responsiveness and play partially mediated the effect of maternal depression on infant cognitive ability (18). In high-resource settings, child abuse has also been associated with poor child growth (19).

### *2.1.3 Social cognitive theory*

In Bandura's social cognitive theory (20), individuals are viewed as "producers as well as products of social systems," involved in a complex interaction with their social environment (21, p. 15). Bandura elaborates on a framework for understanding the interaction of biology, human relationships, and broader social forces by acknowledging various forms of human agency (21). He describes self-efficacy, or a person's understanding of his or her own ability to achieve a desired effect, as a critical component of personal agency, which refers to an ability to act in order to achieve an

outcome (21,22).

For caregivers, parental self-efficacy has been associated with better mental health (23,24). Given that accomplishments associated with a behavior can bolster self-efficacy (22), it follows that child physical wellness could signal effective parenting and lead to better caregiver mental health through improved parental efficacy. Alternatively, poor child health could threaten parental self-efficacy. One study found that self- efficacy did not mediate the impact of caregiver mental health on child physical well-being (25); however, this study did not assess if self-efficacy could be a mechanism by which child physical well-being and thriving positively impacts caregiver mental health.

In addition to personal agency, Bandura discusses proxy and collective agency. Proxy agency involves relying on other members of a social network to complete certain tasks or affect certain outcomes for the person, while collective agency reflects the ability of a coordinated group to have a desired impact (21). Proxy agency becomes particularly important when “people do not have direct control over the social conditions and institutional practices that affect their everyday lives” (21, p. 13). Reliance on proxies allows people to optimize and more successfully manage their lives as a whole; thus, people turn to proxy agency when they are unable to perform an action well or at all.

In rural Uganda, patrilineal kinship structures may be important sources of proxy agency. Kinship networks in rural Uganda have been found to be far more effective units for community intervention for the control of infectious disease than

dividing people into communities based on administrative, political, or geographic boundaries (26). Ugandan kinship networks typically consist of approximately 50-100 people that may live in close proximity or scattered throughout an area. Regardless of physical proximity, kinship networks produce and regulate land ownership, culture, religion and politics (26). An emphasis in such a context on households as a center of power for economic production, decision making, and social/familial organization has been criticized as inappropriate and lacking explanatory power (27). Alternatively, a lack of kinship or family support could be a source of vulnerability for stigmatized women living with HIV.

#### *2.1.4 Therapeutic citizenship*

Kinship is also an imperfect framework for understanding complex social systems, given that social practices are dynamic and change with time. For HIV-infected caregivers, one major change that must be negotiated is the introduction of new health care systems formed in response to the HIV/AIDS epidemic. In rural areas of Uganda and other low-income countries, health access has historically been limited and governments have provided few services. Nguyen et al. (28) argue that in these contexts, kinship has been one of the few “available forms of social solidarity” (p. 32). However, the expansion and creation of a healthcare system to respond to the HIV epidemic introduced a new, and sometimes conflicting, moral economy from that of kinship. This new system values people based on their HIV-illness and health, rather than hierarchy as in kinship system. People living with HIV/AIDS must navigate these two moral economies to preserve both their physical wellbeing through treatment while

maintaining their social status and well-being often in a context of stigma. Nguyen et al. call this new form of belonging to a community of treatment and health services “therapeutic citizenship.” Nguyen et al.(28) suggest that ART:

embodies the historical process by which local ideas and practices in relation to health and the body are articulated with the global political economy of pharmaceuticals and AIDS relief (p. 534).

Therapeutic citizenship then suggests that health behaviors and outcomes do not only result from individual factors but broader forces which individuals must navigate in their environments (28). The identity of PLWHA can be positively shaped through this new form of citizenship; a study in central Uganda found that health workers providing ARVs helped fashion a sense of control over one’s health that encouraged self-management of treatment (29). However, in Mozambique it was found that the scale up of ARV delivery was associated with the medicalization of hunger and promoted competition for scarce humanitarian aid that could contribute to further stigma of PLWHA in the health system and community (30).

## 2.2 The Ugandan context

### *2.2.1 Political history*

Uganda has experienced drastic political and economic changes over the past half century. Historically, the political landscape of present-day Uganda consisted of multiple distinct kingdoms, the largest of which was the Buganda kingdom (31). Through negotiations with the Kabaka (king) of Buganda, Uganda officially became a British

Protectorate in 1894. This protectorate then expanded to include many other kingdoms, for example the Toro, Bunyoro and Busoga. Upon independence in 1962, the Kabaka became president and Milton Obote of the Uganda People's Congress prime minister. Relatively quickly, Obote enhanced the military's power and forced out the Kabaka. Obote's violent repression of political opposition eventually resulted in a loss of public support enabling Idi Amin to overthrow Obote in a 1971 coup d'état (31).

State sponsored violence continued as Amin wrought cruelty on his opposition and, as a former military general, continued to militarize the country. By 1974, the Ugandan army contained over 20,000 soldiers. Amin arbitrarily tortured citizens, murdered rivals, and exiled Asians from the country. In an attempt to resolve military unrest and unite the country in support of his regime, Amin invaded Tanzania. This plan backfired as the Tanzanian army united with dissident Ugandans and forced Amin out of office in 1979. Obote was then able to return to power, quickly reverting to violence as a means of maintaining power. During his second period of rule (1980-1985), Obote is estimated to have killed 100,000 Ugandans (31). In total, an estimated half-million Ugandans were killed by state violence in the 20 years following independence from Britain (32).

In 1986, Yoweri Museveni led what would be Uganda's last coup to date as head of the National Resistance Army. Museveni's rule brought increased political stability, but only after a period of violent conflict. The years of 1987-1989 were particularly violent for residents of Tororo district in eastern Uganda where this dissertation research is based (33). During this period, a religious-based anti-government force led by Alice

Lakwena (the Holy Spirit Movement) relocated to eastern Uganda and engaged in active conflict with Museveni's forces (33).

Over time, Museveni also banned multi-party politics and later removed term limits, which allowed for his reelection in 2006 and 2011. During this time, Museveni oversaw a period of economic growth in Uganda. Nearly 30 years after coming to power, Museveni will face reelection again in 2016 (34). Uganda currently is carrying out a national census in preparation for the election.

### *2.2.2 Language and ethnicity*

Uganda is linguistically diverse, with over 41 languages spoken within its borders and three official languages: English, Luganda, and Swahili. In eastern Uganda, where this study is located, the predominant languages are Dhopadhola and Ateso, which belong to the Nilotic language family. In the study sample, approximately 60% identified as belonging to the Jopadhola ethnicity and just over 70% reported Dhopadhola as their primary language. Jopadhola kinship is patrilineal and women live with the husband's clan once married (33). Other languages spoken by study participants include Luganda and Saamia of the Bantu family (35), and with close proximity to Kenya, Swahili as well. Christianity is the dominant religion in Tororo district which is home to Catholic, Anglican, and Evangelical churches.

### *2.2.3 HIV/AIDS in Uganda*

Though Uganda experienced a high prevalence of HIV infection early in the sub-Saharan African epidemic, the country has experienced a substantial decline in



prevalence since the early 1990s. The magnitude of this decline and the contributing factors, however, are contested (36–38). Much of this debate has centered on the relative role of the “A” (abstinence) and “B” (be faithful) components of Uganda’s national strategy to reduce HIV, as compared to the “C” (condoms) component (37). Other contributing factors include early introduction of voluntary counseling and testing (VCT) and a focus on prevention of mother to child transmission (PMTCT) (38). The extent to which incidence has declined is also debated, with a decrease in prevalence also attributed to high numbers of deaths in people living with HIV (37,39).

Currently, the prevalence of HIV in Uganda among 15-49 year olds is estimated to be 7.2%, which represents a slight increase over the past five years corresponding with a similar increase in incidence. In total, there are estimated to be 1.4 million people living with HIV in Uganda, with about 150,000 new infections (including 15,000 child infections) every year and 62,000 deaths (40). There are several sub-types of HIV-1 infection in Uganda; an epidemiological study out of Rakai found 59.1% of adults to be infected with sub-type D, 15.1% with A, 21.1% with a recombinant form, and 4.3% with multiple subtypes (41). Ugandans infected with sub- type D, as compared to sub-type A or recombinant strains, have been shown to progress to AIDS more quickly (41).

An estimated 54% of those eligible for ART are currently accessing treatment (40); however among children, only 23% ART coverage is estimated and only 29% of exposed children (i.e. children born to HIV-infected mothers) were being tested for HIV in 2009-2010 (42). There are an estimated 1.1 million orphans between the ages of 0 and 17 as a result of the HIV epidemic (40). The majority of financial support for anti-

retrovirals (ARVs) comes from international funders (US\$ 55.6 million), the largest of which is the Presidents Emergency Plan for AIDS Relief (PEPFAR), with the Ugandan government contributing about US\$ 3.6 million (40,42). Uganda revised its HIV/AIDS treatment policy in 2013 to make anyone with a CD4 under 500 (with priority given to those patients with a CD4<350) and all children under age 15 eligible for treatment (43).

A challenge in determining HIV disease progression and severity in children is that CD4 and viral load have lower prognostic value in children, particularly infants. This is because age is a strong predictor of mortality in young HIV-infected children independent of CD4 count (44) and the number of expected CD4 cells in a health child decreases over time. However, results of a meta-analysis indicated that adult guidelines for monitoring by CD4 cell count may be appropriate for children aged 4 to 5 years or older (44). Additionally, while CD4 cell percentage was recommended over absolute count due to less natural fluctuation with age in young children (44), more recent research suggests that the percentage measure may not add much prognostic value over the absolute count (45). Current World Health Organization guidelines suggest when ARVs cannot be provided to all children, either CD4 cell count or percentage can be used to determine treatment course in children between the ages of 2 and 5 years (46).

Uganda has now adopted option B+ for the prevention of mother to child transmission in which all pregnant women receive ARVs for life regardless of their CD4 count (47). The current first line treatment recommended for adults in Uganda is tenofovir-lamivudine-efavirenz (TDF+3TC+EFV) and for young children is either

abacavir-lamivudine-nevirapine (ABC+3TC+NVP) or abacavir-lamivudine-efavirenz (ABC+3TC+EFV) (48).

Tororo district, an eastern region of Uganda where this study is located, has historically experienced rates of HIV infection below the national average. HIV prevalence peaked in Tororo at 13.2% based on antenatal clinic surveillance in 1992 (38), a substantially lower rate than the 18.5% peak nationwide (40). Though the proportion of people living with HIV has declined in this region to an estimated 3.7% prevalence (42), bordering areas in western Kenya have not experienced parallel declines (49). The health of HIV-exposed and HIV-infected children in these eastern districts is complicated by high rates of other health concerns. In particular, malaria rates are substantial in Tororo and Busia, with an estimated 5.57 incident cases of malaria per person year in young breastfed infants (50). HIV services are available at the Tororo district hospital located in Tororo town; however, ARVs are not always available and thus would have to be purchased from a pharmacy at cost to the patient. Tororo also hosts a branch of the non-governmental organization The AIDS Support Organization (TASO), a non-governmental organization that has provided treatment and support services to PLWHA in Uganda since 1987, is also located in Tororo. TASO provides ARVs free of charge to a predominantly female client base (51).

#### *2.2.4 Mental health in Uganda*

**Ethnomedical and explanatory models:** While little has been written on Jopadhola or Iteso ethnomedical models of mental health symptoms or illnesses, the subject was explored in detail among the Baganda of central Uganda in a 1970

ethnography by John Orley (52) synthesized more recently by Patel (53). Among the Baganda, the heart is understood to play an important role in the production of emotions. Accordingly, the heart is also understood as the location of two mental health problems: (1) *emmeme etyemuka*, characterized by a racing heart and fear; and (2) *emmeme egwa*, characterized by fatigue, malaise, and lack of appetite (52,53). In general, mental illnesses were found to be classified as strong or weak, caused by witchcraft or not, and known before the arrival of Europeans or not (52,53).

In a more recent study among the Baganda, Okello and Ekbald (54) presented vignettes describing depressive symptoms to individuals in interviews or focus group discussions. Rather than seeing these symptoms as an emotional problem, people more commonly described the symptoms as an “illness of thoughts,” particularly that one was thinking too much. Nearly 40 years ago, Orley (52) described the Baganda as understanding both the heart and the mind to produce thoughts, resonating with the description provided by Okello and Ekbald (54). Analysis of themes from interviews and focus groups suggested that the cause of these thoughts were seen as socioeconomic. However, people felt differently about the cause of the symptoms if they were described as being recurrent or chronic (54). Researchers have described other Baganda conceptions of depression. Okello and Musisi found depression accompanied by psychosis to be understood by the Baganda as a clan illness (eByekikia) occurring due to an individual failing to appropriately treat the dead (55). Orley (52) also found the Baganda to distinguish between temporary influences (such as from intoxication or spirits) and permanent alterations in thoughts.

**Help seeking:** In Uganda, people suffering from mental health symptoms have been described as seeking care from multiple sources. Traditional healers in Uganda often serve as a resource for resolving disagreements within kinship networks, medical issues that a hospital may have already failed to treat, and bewitchings (56). Based on qualitative interviews with stakeholder from multiple institutional sectors in Uganda related to mental health care (e.g. medical, educational), Nsekero et al. (56) concluded that in rural areas of the country people primarily sought care initially from traditional healers for mental health issues and used higher-level hospital as a last resort. Accordingly, 60% of individual seeking care from traditional healers in Jinja and Iganga in eastern Uganda for mental health related concerns were found to have a diagnosable mental illness (57). Of that 60%, 40% were identified as having a severe mental illness; the most common diagnosis was psychosis (57). These findings were partially contradicted by a study from southwest Uganda where 62% of people seeking care for spirit possession, a common idiom for the effects of traumatic events, first tried a medical intervention (58). A large proportion of those seeking care at medical facilities described that physical symptoms subsided following care while other kinds of symptoms persisted.

Together, these studies highlight that people may engage in multiple types of treatment seeking for different reasons. Nsekero et al. (56) found that causal models of the illness were important in determining where people sought help. Okello and Ekbal (54) also described explanatory models of illness as affecting what treatments people perceived as appropriate; depression for instance was not seen as an illness to necessarily be treated with medicine as the cause was often thought to be

socioeconomic. Another important consideration is that healers are a diverse group; van Duijl et al. (58) found that among traditional healers practicing divination, almost a third incorporated Christian practices.

**Mental health system:** Uganda has one 500-bed national mental health hospital (59). Otherwise, mental health care is incorporated into primary care at local, regional, and national referral hospitals. Across the country, there are 0.08 outpatient facilities and 1.24 psychiatric beds within general hospitals per 100,000 people. There are no community-based residential treatment facilities. There are only 0.09 psychiatrists, 0.02 general doctors, and 0.76 nurses working within mental health services per 100,000 people. In Uganda nurses can diagnose and treat mental health conditions, though not without some restrictions. The majority of primary care doctors have received official in-service training on mental health within the last five years, but this was not true of primary health care nurses. Uganda does have over 200 psychiatric clinical officers who complete two years of mental health specific coursework. While these clinical officers are supposed to be distributed throughout the country in primary care centers, there is often a gap in available mental health expertise at the community level. Though the exact proportion of health funding spent on mental health was not available in 2011, in general due to efforts by the African Development Bank, funding for mental health has improved in recent years (59).

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## Chapter 3. Methods

### 3.1 Data source

#### *3.1.1 Trial overview*

Data for this dissertation research come from the treatment as usual (TAU) control arm of the “Enhancing Ugandan HIV-Affected Child Development with Caregiver Training Study,” a randomized controlled trial (RCT) funded by the National Institute of Child Health and Development. This RCT tests the Meditational Intervention for Sensitizing Caregivers (MISC), a one-year structured training focused on enhancing a caregiver’s sensitivity and attentiveness to her child in order to improve child cognitive and social development. Caregivers were randomized to receive MISC in the intervention arm or health training in the control arm (see section 3.1.3 for additional detail on the TAU condition). Caregiver-child dyads were identified from clinic and NGO referral lists in two rural eastern Ugandan districts, as well as from the roster of concluding studies on HIV treatment and malaria treatment and prevention (the University of California San Francisco PROMOTE Studies 1-3).

Individual-level data were collected from both members of the caregiver-child dyads at four time points: baseline, 6, 12, and 24-months (see Figure 3.1). The RCT included two cohorts: a cohort where the child in the dyad was HIV-infected and another cohort where the child in the dyad was HIV-exposed, i.e. the child was born to a HIV-positive mother but was not his or herself infected. Due to later enrollment, data from all four time points for the HIV-exposed child-caregiver dyads is not yet available; therefore,



only the HIV-infected child-caregiver cohort is included in these analyses. Data collection among the HIV-infected child-caregiver cohort began in March 2012 and concluded in February 2015. Data collected included demographics, indicators of HIV-illness, home environment, caregiver functional impairment, caregiver anxiety and depressive symptoms, caregiver social support, caregiver coping strategies, child physical health and development measures, as well as an array of child cognitive and behavioral measures.

**Figure 3.1:** Data collection timeline



### *3.1.2 Sampling*

The sample for Aims 1 and 3 includes all 60 HIV-infected child-caregiver dyads randomly assigned to the treatment-as-usual (TAU) control arm of the parent RCT. To have been eligible for inclusion in the parent RCT, the child in the dyad must have been aged 2-5 and not have had a history of illness or injury that could have caused a central nervous system insult. Thus, any child that experienced serious birth complications, severe malnutrition, cerebral malaria, bacterial meningitis, or encephalitis as reported by the caregiver was excluded from the study. All caregivers selected for this study were female and resided in either Tororo or Busia district of eastern Uganda. In addition for a caregiver to have been eligible, she had to be willing and able to participate in the year-long program, including not having a severe mental illness or disability that would have

prevented active engagement in the study. The term caregiver is used in this dissertation because while the woman had to be predominantly responsible for caring for the child, she was not required to be the child's biological mother. Therefore, not all caregivers in this study were HIV-infected mothers.

Aim 2 uses a purposive sample of women drawn from the larger sample of caregiver-child dyads included in Aims 1 and 3, selected based on the quantitative data they provided as a part of participation in the parent trial. Specifically, caregivers of HIV-infected children experiencing high levels of depression and anxiety symptoms were part of the sampling frame. Selection was designed to include caregivers with children who were thriving physically and those who were experiencing growth impairment or malnutrition. The rationale for this selection strategy was to generate a diverse sample that would allow for the collection of rich and varied qualitative data. Caregivers were drawn from both major study languages, Dhopadhola and Ateso. In total, nine caregivers were included in the Aim 2 qualitative study. Sampling ceased when saturation was reached. In addition, four trainers from the TAU study arm who provided health training to caregivers were selected for qualitative interviews to supplement the information provided by caregivers.

### *3.1.3 Intervention in the treatment as usual (TAU) control arm*

TAU participants received a year of health training that met the minimum standard of care for families affected by HIV in Uganda in the parent RCT (see Figure 3.1). Specifically, a university-level educated trainer delivered nutrition and medical education based on a 13-topic curriculum developed by the Uganda Community Based

Association for Child Welfare (UCOBAC) with support from UNICEF for families affected by HIV. Trainers provided basic information on HIV/AIDS, other sexually transmitted infections, “positive living”, psychosocial support, basic hygiene and nutrition, family planning, herbal remedies for opportunistic infections, and will making/planning. Trainings occurred biweekly with the location alternating between participants’ homes and the study office (as with the main trial intervention).

All trial caregivers received a grain mix to supplement the study child’s diet. The study included this food package because both study districts have a high prevalence of malnutrition that could have confounded the impact of the training enhancement on child neurocognitive development. The provided food supplement was a locally produced pre-cooked ReadyMix containing millet, soya, sesame, peanuts, rice and sugar. When analyzed for its nutritional content, the supplement was found to contain 2937 IU of Vitamin, iron, and was composed of 5.6% moisture, 20.1% fat, 27.5% protein, 6.5% fiber, and 0.19% fatty (oleic) acid.

### 3.2 Mixed methods typology

To meet the aims of this dissertation, a mixed-methods approach was used, drawing on both quantitative and qualitative data collection and analysis procedures. A mixed-methods approach was developed from the beginning of the research process and was deliberately incorporated into study planning and the formation of research questions (1). Some methodologists argue that mixed methods research consists not only of using qualitative and quantitative data together in the same study, but prioritizing and integrating data from these different methods in a meaningful way (1). To help

researchers determine how to integrate data in mixed methods studies, Johnson and Onwuegbuzie (2) have posed two important questions: (1) within what paradigm will the research be formulated and carried out; and (2) will the design include the sequential or concurrent collection qualitative and quantitative data?

### *3.2.1 Epistemology*

Johnson and Onwuegbuzie's (2) first question regarding research paradigms forces researchers to consider their epistemology. Crotty defines epistemology as "the theory of knowledge embedded in the theoretical perspective and thereby the methodology" of any research study (3, p. 3). In mixed methods research, what constitutes an appropriate epistemology is widely debated (1,4,5). This debate centers on whether or not qualitative research (typically associated with a constructivist epistemology) and quantitative research (often seen as objectivist in nature) can or should be combined in meaningful ways to answer a scientific question. Constructivists understand knowledge and truth as relative and constructed within a particular context, which directly conflicts with the objectivist standpoint that truth is absolute and discovered as an object in and of itself by researchers (6). Thus, the key epistemological challenge in mixed methods research becomes integrating knowledge that is viewed as fundamentally different in nature. Accordingly, it has been suggested that while both epistemologies can be combined with multiple theoretical perspectives, one cannot simultaneously be an objectivist and a constructivist (3). However, within qualitative research, there are approaches that are more objectivist in nature (e.g. Glaser's approach to grounded theory research). Ethnographic research, despite being largely

constructivist in nature, often also incorporates quantitative data.

Pragmatism suggests that both types of research are not only valuable but can be used to answer the same question from different angles and even expand the scope of the research (7). Pragmatists emphasize the research question itself, and do not commit to any single philosophy of knowledge (8). Talking about the use of mixed methods in discourse analysis, Ainsworth-Vaughn (9) states:

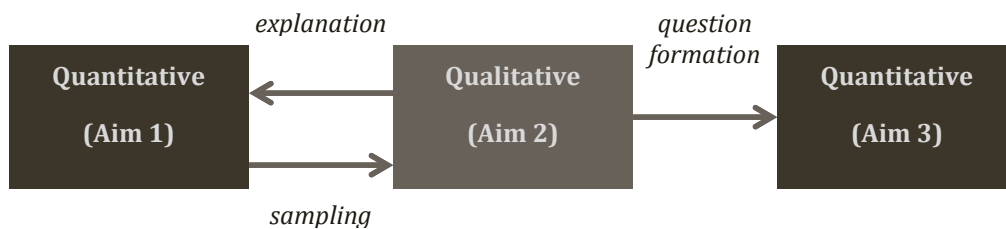
The paradox is that each speech activity is both unique and patterned. When we do quantitative work, we ignore uniqueness, in order to establish a definition that will apply across events. We need a definition in order to do accurate counts, and counting the frequency and distribution of the activity is our purpose. However, when we do qualitative studies of discourse, we try to capture a sense of the complex, unique moment. We show the existence of choice among multiple possible meanings, and we show the relationships between choice and context. Generalizations are still made or at least implied, but not in the same way (p. 16-17).

Describing the nature and mechanisms of the effect of caregiver mental health on child physical health involves an examination of the complex interaction of biology, social environment, and the mind. As Ainsworth-Vaughn (9) describes, this relationship will likely be both “unique and patterned,” making it appropriate, even if contradictory, to say that truth is both inherent and discoverable as well as co-created and context specific. By using mixed methods and a pragmatic approach in this dissertation, the author both generalizes knowledge to other related settings and explores the particulars of the relationship in a specific context in a deep and meaningful way (7).

### 3.2.2 Mixed methods design

Given the pragmatist epistemology underlying this dissertation research, equal weight was given to the qualitative and quantitative approach in developing research questions and interpreting findings. The timing of the data collection and analyses enabled the use of a multi-phase mixed methods design (1). Initial analyses were quantitative, and the quantitative data then drove the sampling of participants for qualitative interviews. The qualitative data informed variable selection and interpretation for Aim 1 and the selection of research question to be addressed in aim 3 (see Figure 3.2). In addition, the qualitative findings from Aim 2 were intended to help provide some insight from the perspective of caregiver's about why a relationship may or may not have been observed quantitatively in Aim 1.

**Figure 3.2:** Mixed methods research design



## 3.3 Methods

### 3.3.1 Aim 1: Mixed-effects regression

Linear mixed-effects regression modeling was used for Aim 1. Due to changes in developmental processes in early childhood (10), child age served as the time axis for all analyses. A restricted maximum likelihood estimator (REML) was used as it provides

less biased estimates of covariance parameters and the standard error of beta coefficients in balanced data (11–13).

Mixed-effects regression allows for the inclusion of both fixed and random effects. While fixed effects reflect a population-average, random effects vary by individual (14,15). A random effect allows an individual's mean values to vary from that of the overall sample, while fixed effects reflect systematic differences between individuals due to a predictor. Using mixed-effects regression techniques allowed for trajectories of child growth and HIV-illness to be modeled as a function of increases in caregiver mental health symptoms over time (fixed effects), while simultaneously accounting for correlations among repeated measures within a dyad over the four study time points (random effects). In subject-specific models, the partitioning of variance allows for the examination of how individual trajectories vary over time, as both the individual's intercept and/or slope can be allowed to randomly vary (14,15).

Accounting for correlation among individuals over time is essential because this correlation constitutes a violation of the assumption of independent observations needed in regression analyses and can cause inefficient estimates of beta coefficients (16).

Without accounting for positive correlation among repeated measures in the same individual, standard error estimates could be too high and potentially cause incorrect inferences. Because randomization in the parent RCT was performed by sub-county, there was also a potential for clustering by location of residence in the data used for Aim 1. To compare models that included sub-county as a random versus a fixed effect, a Hausman specification test was used (17). A significant p-value resulting from the

Hausman test indicates that the inclusion of the variable as a fixed effect resulted in a significantly better model fit.

A repeated measure analysis of covariance (RM-ANCOVA) can also be used to model longitudinal data. However, RM-ANCOVA requires comparisons in outcome to be made by group with caregiver mental health symptoms treated as a binary variable (18). While dichotomizing caregiver mental health into the presence or lack of disorder would have aided in interpretability and increased clinical utility, information would have been lost and statistical power reduced. Further, choosing a cut off to indicate clinically significant symptoms would have been difficult without a local validation study and risked misclassification.

Another option for longitudinal data would have been to only include a lagged predictor from one prior time point, but this too causes a reduction in the amount of information used. By modeling caregiver mental health as continuous change in symptoms from baseline, the time-varying nature of caregiver mental health was accounted for across various time lags without a substantial loss of information. Based on previous studies that pointed to the importance of chronic versus episodic symptoms, caregivers were categorized using data from all time points in a separate set of regression analyses.

Before running mixed-effects regression analysis, exploratory data analyses (EDA) were conducted. EDA for the population mean included assessing the cross-sectional relationship between change in caregiver mental health symptoms and change in growth and HIV-illness outcomes at baseline; graphing the unadjusted relationship



between these variables across time; checking variable distributions with boxplots, histograms and summary statistics; and assessing the size and patterns of individual residuals in the average outcome modeled over time. EDA for the variance structure included the use of scatterplots of residuals at each time point; assessment of the empirical covariance matrix and correlation structure across different time lags; and comparisons of regression analyses run with different parametric estimations of the variance structure using AIC and BIC statistics.

Given that this dissertation research is observational, the potential for confounding was carefully considered. To control for potential confounding, multivariate analyses were conducted with selection of covariates informed by causal studies between the potential confounder and outcome, confounders commonly included in literature on this topic, theory, and associations empirically observed in this data set between covariates and both the outcomes and predictor.

A second concern was missing data. All variables were carefully assessed for level of missingness and patterns of missingness were explored. While no variable was missing more than 10%, data was missing due to loss to follow-up. At 6-months, 97% of dyads had at least one member complete an assessment at 6-months. This figure fell to 92% at 12-months and 90% at 24-months. Multiple imputation by chained equations was used for missing covariate measures, individual scale items, and data missing due to loss to follow-up (19). This method is valid under an assumption of data being missing at random or missing completely at random; predictors of missingness within our dataset were explored, though there is always a concern that an unmeasured variable could

predict missingness.

### *3.3.2 Aim 2: Qualitative data collection and analysis*

**Characteristics of qualitative research:** Qualitative approaches are ideal for exploring the why and how of a social process that is embedded in, and influenced by, contextual factors. Qualitative research often differs in meaningful ways from quantitative approaches beyond the simple fact that the unit of analysis is textual rather than numerical. Rather than the goal being to generalize knowledge, qualitative research generally serves to inform the reader of the specifics of a given culture, place, and time from the perspective of those who are living the experience of interest. Accordingly, a key characteristic of qualitative research is a focus on presenting an emic rather than an etic perspective (8).

A second important characteristic of qualitative research is the use of a holistic perspective. Rather than focusing on a pre-defined set of relationships between variables, qualitative research can take on an inclusive and exploratory nature allowing important avenues of investigation to emerge from the participants and the data they provide. Allowing flexibility in the design and implementation of data collection and analysis facilitates the exploration of emergent themes (8). In addition, as the researcher is the instrument in qualitative research, he or she may have an impact on data collection, analysis, and/or interpretation. Rather than attempt to minimize bias as is common in quantitative approaches, qualitative researchers may embrace their influence on the data through engaging in reflexivity. This can be done by actively thinking, questioning, and memoing throughout the research process.

**Aim 2 data collection:** As the goal of Aim 2 was to gain a locally informed understanding of the relationship between caregiver mental health and child physical health, purposive sampling was used to locate information rich people rather than representative individuals. Specifically, women were sampled based on their responses to quantitative study measures. Sampling was guided by attempts to include:

- women who indicated experiencing elevated depression or anxiety symptoms at some point in the first 12 months of the trial as measured by an adapted version of the Hopkins Symptom Checklist-25;
- children classified as healthy at all time points on height for age, weight for age, and weight for height or children classified as moderately or severely malnourished during at least one study assessment on height for age, weight for age, and weight for height;
- women of a variety of ages;
- participants of multiple language groups;
- children of both sexes.

By selecting caregivers who expressed many mental health symptoms and had children with either good or poor physical health, a variety of perspectives were sought that served to answer “why” a relationship between caregiver mental health and child physical health might exist. The importance of social support (such as kinship support and proxy agency) in the process of caregiving was specifically asked about as a possible answer to “why”

some children of depressed mothers experience poor growth and nutrition while others thrive.

In addition, four study staff members who had provided training to women enrolled in the treatment as usual condition in the caregiver/HIV-infected child cohort were selected for interviews. One staff member could not be interviewed as he no longer worked for the organization and one staff member was not interviewed because he was hired after training of the HIV-infected child cohort was mostly completed.

Qualitative data was collected through semi-structured in-depth interviews. Four interviewers (three males and one female) were trained for two days by the author (SM) and a postdoctoral research fellow (PRF). SM and the PRF supervised data collection, meeting daily with interviewers to debrief on challenges and emerging themes. In addition, transcripts were reviewed by SM and the PRF throughout data collection to allow for ongoing training, to determine topics to discuss in second interviews (if deemed necessary), and allow for iteration in data collection. All interviewers spoke English and at least one participant language (Ateso or Dhopadhola). They were either college graduates or in one case were currently enrolled in university and were completing an internship with Global Health Uganda (GHU), the local implementing partner of the parent RCT.

Participants were first contacted by a GHU staff member to see if they were interested in participating in the qualitative portion of the study. The staff member (usually the participant's trainer) asked if they could be contacted by one of the four interviewers. Participants who agreed to be interviewed and provided oral informed

consent were interviewed at a quiet, private location and time chosen by them, but typically at their own homes during the day. A second interview was scheduled if the first interview could not be completed in full or if upon review of transcripts and discussion among the research team more questions remained for the participant.

Interviewers worked in pairs with one individual solely taking notes in English due to the difficulty interviewers experienced writing quickly in their mother tongues. The person conducting the interview also kept notes and these were compared immediately following the interview to develop a final transcript. Transcripts were read in full by SM and discussed with interviewers during the study follow-up period.

The analysis process began with re-reading transcripts. Drawing on elements of grounded theory (20), line by line coding was then used on all transcripts to allow for consideration of emergent themes. In addition, transcripts were then reviewed with two a priori codes (effect of caregiver on child, and effect of child on caregiver). Codes were reviewed and collapsed into larger themes and matrices were used to look at how emergent codes overlapped with the two a priori codes. Memo writing was used to explore themes and how they were interrelated. Questionnaires were then developed based on the themes emerging from the data judged to be most important, and transcripts were all re-reviewed for content related to these themes. Quotes included in the manuscript were selected based on how well they illustrated study themes with particular attention given to quotes that tied multiple themes together and provided a rich or thick description. In addition, quotes from multiple participants were sought. All quotes were again reviewed in the full context of the transcript before inclusion.

To provide further detail on the context in which caregivers were raising HIV-infected children in Uganda, case studies were developed. Case study research is defined as the “study of an issue explained through one or more cases within a bounded system” (8, p. 73) The concept of “boundedness” is critical in case study research; a case occurs within a particular place and time but can range from an event or an individual’s life history to a community or organization (21). In this study, the “case” was the caregiver, currently engaged in caring for a young child and the predominant issue of focus was the experience of raising a child while living with HIV and high levels of depression or anxiety related distress.

A defining feature of case study research is that it involves the use and integration of information from multiple sources, ultimately to be able to provide a thick description of the context in which the case occurs (8,21). To create cases, all quantitative and qualitative data provided by the caregiver were reviewed to create a narrative description of the caregiver’s experience. The codes, themes, and memos already developed in the previous qualitative data analysis process were also reviewed. Cases were selected to illustrate and add to important themes while also representing a range of caregiver experiences.

**Considerations in qualitative research:** To meet Aim 2, not only was it necessary to capture caregiver’s perspectives on the relationship between their mental health and their child’s physical health, but a sound interpretation of the data produced by these caregivers was essential. Two considerations in qualitative research that can help ensure a sound interpretation are credibility and dependability. Credibility is achieved

when the researcher adequately understands and describes the phenomenon of interest (22). This is different from the concept of internal validity in quantitative studies as there is not one “truth” to be accurately captured.

Credibility can be enhanced by engaging in the study and the study environment for an extended period of time. Though the period of data collection for Aim 2 was short, multiple visits over a period of four years allowed the researcher to prolong engagement. A second strategy is to triangulate by collecting data from multiple sources or having multiple people participate in the analysis and interpretation of data. For Aim 2, data was collected from trainers and caregivers. In addition, a second researcher reviewed the interpretation of the data. Dependability is achieved when another person can review the data collection and analysis process and understand how the researcher arrived at their interpretation of the data (22). This does not mean that two people will get the same result when analyzing the same data. To enhance dependability, in addition to providing a detailed overview of the research process, analysis notes and memoing were used and all coding was retained.

### *3.3.3 Aim 3: Structural equation modeling*

A cross-lagged panel analysis (23) was used in Aim 3 to assess the longitudinal interrelationship of caregiver mental health and child growth. This method allows for the estimation of four types of relationships:

1. Synchronous or the cross-sectional associations between caregiver mental health and child growth at each study time point;

2. Auto-correlation or the degree of stability in both caregiver mental health and child nutrition over time
3. Cross-lagged or the association of a lagged caregiver mental health with child growth and nutrition as well as a lagged child growth and nutrition variable with caregiver mental health;
4. And lastly, residuals, or associations between error terms for a given measure (24).

The advantage of cross-lagged panel models is that the interrelationship of two variables can be estimated simultaneously while accounting for the intra-relationship of the predictor and outcome over time. This then enables comparisons of the relative strength of these different associations (24). The examination of the relationship between mental health and social capital in Burundi by Hall et al. (25) provides an example of cross-lagged panel analysis being used in global mental health research for this purpose. They found that while social capital predicted later social depressive symptoms and associated functional impairment, depressive symptoms and functional impairment did not predict social capital.

In addition to the structural model, structural equation modeling methods allow for the creation of measurement models for latent constructs, in this case caregiver depression and anxiety. If caregiver mental health was not treated as latent variable, it is assumed that it is measured perfectly. While mental health scale scores are commonly treated as manifest in analyses (and thus were treated this way in Aim 1 for comparability



with previous research on the topic), this assumption can result in inappropriate modeling of measurement error and can lead to an overestimation of variation in the latent predictor, inflated standard errors or beta coefficients, and an attenuation in the relationships estimated between the predictor and other variables (26).

To create the measurement model, first exploratory factor analyses were conducted for the mental health symptom scale at each time point. Exploratory factor analysis (EFA) explains the covariance among observed items as a product of one or multiple latent factors. EFA was used to identify the factor structure underlying the mental health symptom scale, the 25-item Hopkins Symptom Checklist (HSCL-25). Multiple solutions were considered and several strategies were used in the choice of number of factors including theory, the number of eigenvalues over 1 produced in a principal components analysis, scree plots, and a parallel analysis (27).

Typically, 1 or 2 factors were suggested to underlie the symptom items at each time point. Confirmatory factor analyses (CFA) were then performed to test the measurement model at each time point developed with a reduced set of items based on low loadings ( $<0.4$ ) or very high uniqueness ( $>0.8$ ) in the EFAs. In CFAs, items that did not load significantly at multiple time points were considered for being dropped from the model. A polychoric variance structure was used in the CFAs due to the ordinal response pattern of scale items (28).

A longitudinal CFA was then performed with the revised measurement model, first allowing all loadings and thresholds to vary at each time point. Loadings for the same item were then constrained to equality and this nested model was tested against the

saturated model using likelihood ratio tests (24,29). The rationale for constraining item parameters to equality across time is to ensure that changes in the variable over time are due to true changes in the latent factor, not changes in individual item measures that may be independent of changes in the true construct of interest (30). Modification indices were then used to determine problematic items (24,29) and items that were invariant were dropped. This procedure was repeated in holding thresholds equal over time and resulted in no additional items being dropped.

Measurement and structural model fit were assessed using goodness of fit indices including the Comparative Fit Index (CFI), Tucker Lewis Index (TLI), and the Root Mean Square Error of Approximation (RMSEA). A CFI and TLI of over 0.9 was considered indicative of good fit and over 0.95 excellent fit. An RMSEA of 0.05 or under was considered good fit, 0.06 to 0.08 adequate or acceptable fit, and over 0.1 poor fit (24).

Once the measurement model was developed, the structural components of the model were added, specifically the outcome of child growth and all interrelationships between outcome and predictor. Initially, a saturated model was run that included all auto-regressive, cross-lagged effects for one time lag, and error correlations with no constraints on the equality of paths over time. To improve model precision, we then constrained paths to equality and tested the change in fit with likelihood ratio tests for nested models. The model constraints included:

- 1) auto-regressive coefficients between the predictor of caregiver mental health over time;

- 2) auto-regressive coefficients between the outcome of child growth over time;
- 3) cross-lagged effects of caregiver mental health on child growth; and, the
- 4) cross lagged effects of child growth on caregiver mental health;

If the constrained model did not fit significantly worse than the saturated model, the constraint was retained. All chosen constrained paths were then included in a model and tested again against the saturated model. The model also included associations between the predictor and outcome at baseline and between the residuals of the predictor and outcome at each follow-up time point. The rationale for including this association was to adjust the cross-lagged and stability estimates for confounders that were a cause of both predictor and outcome but were not modeled (24,31).

#### *3.3.4 Ethical considerations and approval*

The research protocol for the parent RCT was approved by both U.S. and Ugandan-based Institutional Review Boards. Makerere University's School of Medicine Research and Ethics Committee (SOMREC) provided the local Ugandan ethical review. Michigan State University's (MSU) IRB provided the U.S. review (IRB protocol # i039713), as one of the two parent RCT MPIs is based at MSU. Johns Hopkins University signed an IRB Authorization Agreement with Michigan State University allowing their IRB to be the official IRB of record. Ms. Murray was added to the MSU IRB protocol as a student investigator, and the analyses proposed in Aims 1 and 3 of this study were given exempt status given the use of secondary data without identifiers. For Aim 2, an amended IRB protocol was submitted and approved by both the Michigan

State and Makerere University IRB. Participants were consented separately into the qualitative sub-study with an oral consent script that emphasized the voluntary nature of participation and that the decision to participate would not in any way impact participation in the larger RCT (for caregivers) or employment (for trainers).

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## **Chapter 4: A longitudinal investigation of the impact of caregiver mental health on child growth and HIV-illness in Uganda**

### **4.1 Abstract**

Depression and anxiety are common among women living in low-resource settings globally. Prior research demonstrating the impact of maternal depression on child physical health and growth in low-income countries has been mostly limited to populations with a low prevalence of HIV. Using data from 60 caregiver child dyads enrolled in the control arm of a randomized controlled trial of a parenting skills intervention in rural eastern Uganda, we longitudinally assessed the impact of caregiver depression and anxiety symptoms on the growth of HIV-infected children. As a secondary outcome, we evaluated the effect of caregiver mental health on indicators of child HIV-illness. Change in combined caregiver depressive and anxiety symptoms over time had a minimal, non-significant impact on child height-for-age ( $\beta=-0.01$ , 95% CI: -0.27, 0.25) and weight-for-age ( $\beta=0.13$ , 95% CI: -0.17, 0.43). Experiencing chronic as compared to episodically high symptoms or consistently low symptoms had a non-significant dose response relationship with poorer height-for-age and weight-for-age. Higher caregiver depression and anxiety symptom scores at baseline, but not an increase in symptoms over time, were significantly associated with higher log viral load in children ( $\beta=2.11$ , 95% CI: 0.06, 4.17). There were no statistically significant effects of caregiver mental health on child CD4 cell count. Further studies should evaluate if the effect of caregiver depression and anxiety may be attenuated or different for HIV-infected children as compared to unaffected children.

## 4.2 Introduction

### *4.2.1 Intergenerational impact of maternal depression and anxiety*

Mental and substance use disorders rank as the fifth leading cause of disability worldwide (1). Depression and anxiety account for over half of the disability adjusted life years (DALYs) associated with this group of conditions (1). Globally, these common mental disorders are particularly pervasive among women, who have been found across diverse cultures to be twice as likely as men to experience depression in their lifetime (2). In low and middle-income countries (LMIC), where known risk factors for depression such as low educational attainment and poverty are widespread (3), the prevalence of perinatal depression ranges from about 15 to 25% (4–6). Anxiety is also common among mothers in LMIC; a systematic review of the prevalence of postnatal anxiety among women in Africa identified two studies with an average prevalence of 14 (5).

In addition to being common and burdensome to the mother, the effects of maternal depression and anxiety are intergenerational. Depression in the antenatal period has been linked to lower birth weight, particularly in LMIC where depressed mothers have two times the risk compared to those in the U.S. of having a lower birth weight child (7). The impact of antenatal depression on low birth weight may operate through increased risk of preterm birth or intrauterine growth restriction (7). In Brazil, depressed pregnant women were over twice as likely as non-depressed women to have a preterm birth (8), while in India, women who experienced depression during pregnancy experienced greater than three times the risk of intrauterine growth restriction (9). In western Africa, children of depressed mothers were found to have an elevated hazard of

developing febrile illness compared to those of non-depressed mothers (10). A meta-analysis of 17 studies in LMIC (11) found that children of depressed mothers experience impairments in physical growth and nutrition more often than children of non-depressed mothers. Limiting this analysis to data from longitudinal studies, the odds ratio of underweight and stunting in children of depressed versus non-depressed mothers was 2.2 and 2.0 respectively (11). The population attributable risk (PAR) of maternal depression was estimated from two longitudinal studies as ranging from 22.5-29.4% for stunting and 27.0-27.5% for underweight (11).

#### *4.2.2 Gaps in current research*

Gaps remain in our understanding of the relationship between maternal depression and anxiety and child health and growth in the context of HIV. Prior studies of the relationship of maternal mental health and child growth and nutrition in LMIC focus predominantly on infants as opposed to including young children (11). However, it is critical to understand the impact of maternal mental health beyond infancy and throughout early childhood (14). While growth faltering begins early with malnutrition in utero and in infancy, failures to meet length and height standards continue through a child's third year and early childhood is a critical time for "catching up" in weight for height (21,22). Further, undernutrition during early childhood can have long-term impacts on physical and cognitive development (23), school performance (24), and immune functioning (25). A study in the U.S. found that moderate to severe maternal postnatal depressive symptoms within the child's first year of life led to a 40% increase in the odds of being low height for age at age 4 and 48% increase at age 5 (26). In

addition, only a limited number of studies on the association between maternal depression and anxiety and child growth are longitudinal (4 of 17 in a recent systematic review) limiting the potential for casual inference (11).

#### *4.2.3 Maternal mental health and child physical well-being in HIV-affected families*

With 16.7 million women living with HIV worldwide (12), it is critical to understand the impact of maternal mental health on child growth and physical health in HIV-affected families. HIV-related illness can threaten livelihoods and exacerbate poverty (13), which can in turn negatively impact healthy brain and immunological development in young children living in these HIV-affected families (14). HIV-infected children under five are particularly vulnerable to poor growth, including low birth weight, stunting, being underweight, and to a lesser extent, wasting (15,16). While treatment with anti-retrovirals (ARVs) has been found to improve the growth trajectory of HIV-infected children (16), only one third of HIV-infected children in Uganda were estimated to be receiving ARVs in 2013 (17).

Despite increased risk for poor child growth, there are a limited number of studies on maternal depression and child health and development among HIV-infected children or even HIV-affected families. Among HIV-affected families, there are conflicting findings on the impact of maternal mental health on child growth. In a cross-sectional study that included HIV-infected and uninfected mothers in Malawi, infants aged 9-10 months were found to have lower mean height for age z-scores (HAZ) if their mothers reported depression (18). Higher prevalence of diarrheal illness has also been found in children of HIV-infected depressed mothers compared to HIV-infected non-depressed

mothers (19). Conversely, a recent longitudinal study of HIV-positive women and their HIV-infected or HIV-uninfected but exposed infants in Tanzania found no association between prenatal depression and child stunting or underweight and a protective effect of postnatal depression on child underweight status (20).

#### *4.2.4 Study aims*

To help address these gaps in the literature, we longitudinally assessed the effect of caregiver depression and anxiety on child growth and physical health among HIV-infected young children aged 2-5 years. We hypothesized that improvements in caregiver mental health over time would predict improvements in growth and indicators of HIV-illness progression. We also hypothesized that chronic or recurrent depression and anxiety symptoms would be associated with a greater risk of poor child growth and HIV-illness progression at the end of follow-up compared with either episodic or consistently low symptoms. Undernutrition in children, in part due to poor maternal nutrition, is estimated to be responsible for 35% of morbidity in children under five and cause 3.5 million deaths (27). Interventions to treat HIV and prevent malnutrition depend on a functioning caregiver. For instance, HIV-infected children are dependent on their caregivers to acquire and administer medications and income-generating projects to improve food security require an active and engaged caregiver. Understanding the relationship between maternal mental health and child growth in the context of HIV could guide intervention development and make a substantial contribution to improving child health globally.

## 4.3 Methods

### *4.3.1 Study design and participants*

This secondary data analysis used data from the treatment-as-usual (TAU) control arm of a randomized controlled trial (RCT) in rural eastern Uganda. The main goal of the parent RCT was to assess the impact of a caregiving skills intervention, Mediation Intervention for Sensitizing Caregivers (MISC), on cognitive development young children born to an HIV-positive mother. While the parent trial enrolled dyads containing either an HIV-infected or HIV-exposed but uninfected child, this study uses the 60 caregiver-child dyads with an HIV-infected child. These caregiver-child dyads were recruited into the parent study from local clinics and non-governmental organizations providing prevention of mother to child transmission (PMTCT) and HIV-care in the study districts. Dyads were enrolled and caregivers provided written informed consent between March 2012 and November 2013.

Trial eligibility criteria included that a child was born to an HIV-infected mother, was between the ages of two and five years at enrollment, and did not have a prior illness or injury that could have caused central nervous system damage. Any child that experienced serious birth complications, severe malnutrition requiring hospitalization, cerebral malaria, bacterial meningitis, or encephalitis was excluded from the study. Caregiver eligibility was limited to women living in one of two study districts (Tororo or Busia) who were willing and able to participate in the year-long program. Exclusion criteria included having a severe mental illness or disability that would prevent active engagement in the study. For the purposes of this study, caregiver was defined as the

person who reported predominantly caring for the child. In total, 10 dyads (14%) were excluded (see Figure 4.1).

As a part of being in the TAU arm of the trial, all caregivers received a year of health training that met the minimum standard of care for families affected by HIV in Uganda. A trainer with a minimum of a bachelor's level education from our local partner, Global Health Uganda (GHU), delivered nutrition and medical education to caregivers from a 13-topic curriculum developed by the Uganda Community Based Association for Child Welfare (UCOBAC). Training occurred biweekly alternating between the caregiver's home and study office to parallel the intervention provided to the MISC participants. All trial caregivers also received a locally produced pre-cooked nutritional supplement monthly that contained millet, soya, sesame, peanuts, rice and sugar.

#### *4.3.2 Measures*

Caregiver and child specific measures were administered in-person at four time points: baseline (pre-health training), six-months (during health training), 12-months (following the end of health training), and 24-months. For the purpose of the current analysis, we used the caregiver measure of depression and anxiety symptoms, demographic information, and child health measures. Caregiver demographics included marital status (married vs. unmarried), education (any vs. none), language (the predominant language of Dhopadhola vs. other), sub-county of residence, and HIV-status. We did not include whether a caregiver was the child's biological mother. Caregiver relationship to the child was highly collinear with caregiver HIV status since eligibility criteria included that a child was born to an HIV-infected mother; thus, all

women who were the child's biological mother were HIV-positive. In addition, we characterized women into wealth groups (top 20<sup>th</sup> percentile, middle 60<sup>th</sup> percentile, and bottom 20<sup>th</sup> percentile) based on factor scores derived from exploratory factor analysis of eight material possession items and six housing quality items. The health trainers administered the caregiver measures.

Child outcomes were assessed during a physical exam provided by a GHU study nurse or clinical officer. Child health measures included height, weight, and questions for the caregiver on the child's health history including if a child was born on term, number of months breastfed, and whether or not the child was receiving antiretroviral therapy (ART). Indicators of child HIV-illness were also assessed at each time point via blood sample. All questionnaires were translated into three study languages: Dhopadhola, Ateso, and Luganda. The translation process included independent back translation with reconciliation of differences made by group consensus.

**Child growth:** Child growth was operationalized into two primary study outcomes: height for age z-score (HAZ) and weight for age z-score (WAZ). Height was measured in centimeters (cm) to the nearest 0.1 cm using a measuring board and weight was measured in kilograms (kg) to the nearest 0.1 kg on a standing scale. Age was measured by self-report and/or review of birth certificates or baptism card when available. Anthropometric measures were standardized using gender and age-specific World Health Organization (WHO) growth curves developed separately for children aged 0-5 (28) and 5-19 (29). The HAZ and WAZ scores were analyzed as continuous variables; however, to describe the population at baseline we categorized children with



HAZ and WAZ scores below -2 as stunted and underweight respectively, per standard practice. At baseline, children were considered wasted (a measure of acute undernutrition) if their height for weight z-score was  $<-2$ .

**Child HIV-illness:** Child HIV-illness progression was operationalized into two secondary outcomes: viral load and CD4 cell count. Blood samples from HIV-infected children were collected at each time point at the GHU study office. Samples were analyzed at the Joint Clinical Research Centre Laboratory in Mbale, Uganda. Viral load was measured by milliliter of blood and CD4 cell count per microliter. Both viral load and CD4 cell count were measured continuously. Viral load was transformed to a logarithmic scale due to a highly right-skewed distribution. From baseline through 12-months, the lowest viral load that could be detected was 400, but this changed to 40 at the 24-month follow-up visit.

**Caregiver symptoms of depression and anxiety:** Caregiver depression and anxiety symptoms were measured using the Hopkins Symptoms Checklist-25 (HSCL) (30,31). The HSCL-25 contains 25 symptom questions: 10 that measure anxiety and 15 that measure depression. Participants used a Likert scale of 0 (not at all) to 3 (a lot) to rate how often they experienced each symptom within the last two-weeks. The HSCL has been used to assess depression and anxiety in multiple sub-Saharan African contexts (32–35) including in HIV-affected populations (36,37). The HSCL depression subscale was also previously adapted through qualitative research with HIV-infected adults in rural Uganda and locally validated (38,39) using a process described elsewhere (40). Although the scale was validated in a Luganda speaking population, the HSCL-depression subscale

has previously been translated for use in another Luo language (the family to which Dhopadhola belongs) and exhibited good internal consistency (41). Cronbach's alpha for internal consistency of the combined depression and anxiety scale at baseline in our study was 0.82. We modeled HSCL score as a continuous variable after averaging all 25-items into a single scale score, per standard practice (31,33,42,43), that could range from 0 to 3.

For an additional exploratory analysis, we also created measures of symptom chronicity over the 24-month follow-up period. To do this, we categorized symptoms at each time point as high if the average HSCL score was greater than or equal to 1.0. A score of 1.0 is similar to a cut-off for a refined version of the HSCL depression subscale used in another sub-Saharan HIV-affected population (1.06) that showed high sensitivity and specificity (20) and approximated the top quartile of the baseline HSCL score distribution (1.02). If a person never experienced a high level of symptoms (i.e. if at every assessment their average score was less than 1.0), they were classified as low symptom for their time in the study. If they experienced a high level of symptoms at only one time point, they were classified as having episodic symptoms. If they experienced a high level of depression and anxiety symptoms at two or more time points, they were considered to have chronic symptoms.

#### *4.3.3 Analysis*

We evaluated the relationship of the study outcomes with caregiver depression and anxiety symptoms using linear mixed-effects regression models (Stata's XTMIXED package) with a restricted maximum likelihood (REML) estimator and exponential variance structure. We included the intercept as a random effect for the caregiver-child

dyad to account for correlations among repeated measures over time. We included sub-county (the unit of cluster randomization) as a fixed effect rather than a random effect due to a small intraclass correlation coefficient ( $<0.04$ ) for sub-county across models and a significant Hausman test result for two study outcomes suggesting the random effect estimation would be inconsistent (44). For comparability across outcomes, we calculated Cohen's  $d$  effect sizes by standardizing beta regression coefficients using the variance of the outcome at baseline (45). Both baseline caregiver average HSCL score and change in score over time were included as predictors in regression models.

Covariates for all analyses were selected a priori based on 1) a review of relevant literature and 2) association with both change in study outcomes over time and caregiver distress at baseline. Time-fixed covariates included baseline caregiver education, caregiver HIV status, language, caregiver age, child sex, number of months breastfed, and whether the child was born on term. Time varying covariates included caregiver marital status, wealth group, child age, and child ART status. Multiple imputation with chained equations (46) was used to account for item-level missing data on the HSCL-25, missing covariates, and missing assessments due to loss to follow-up. Two exceptions were marital status and child age for those lost to follow-up; marital status was carried forward due to low variation in this variable across time and child age was calculated by adding the intended follow-up time to baseline age. All analyses were conducted with Stata 13 (47).

For our mixed-effects regression models, we performed power calculations using Stata's *power repeated* function. We estimated that in our sample using an alpha of 0.05

and based on the observed covariance matrix for repeated measures, we had 80% power to detect a medium Cohen's *d* effect size of 0.45 to 0.50 (45). A post-hoc power analysis for our exploratory regression models analyzing HSCL symptom chronicity using Stata's *powerreg* function suggested an achieved power of 51%-74% depending on outcome. The RCT was approved by the Michigan State University Internal Review Board (IRB) and Makerere University's School of Medicine Research and Ethics Committee (SOMREC) in Uganda.

## 4.4 Results

### 4.4.1 Caregiver and child characteristics

Of the 60 dyads enrolled at baseline, 58 (97%), 55 (92%), and 54 (90%) dyads had at least one member (caregiver or child) complete an assessment at the six-month, 12-month, and 24-month follow-ups, respectively (see Figure 4.1). Child and caregiver characteristics at study baseline are displayed in Table 4.1. The average age of the enrolled children at baseline was 3.34 years and approximately 40% were male. The majority of children were born on term (91%) and children were breastfed for an average of 15 months (range 2-26). At baseline, approximately a third of children were stunted, one quarter were underweight, and just over 10% were wasted. Average caregiver age was 35 years (range 18-60). Over three quarters (77%) of caregivers were the child's biological mother; of women who were not the biological mother, 25% were HIV-positive. Most caregivers reported being married at baseline (65%) and spoke Dhopadohla (77%). One fifth reported never receiving any formal education. Caregivers had an average HSCL score of 0.83 at baseline (range 0.08-2.08).

#### 4.4.2 Regression analyses

**Change in caregiver symptoms:** The results of the mixed-effects multivariate regression models are presented in Table 4.2. Average caregiver HSCL scores at baseline and change over time were not significantly associated with child HAZ and WAZ scores. The trend was that HAZ ( $\beta=-0.74$ , 95% CI: -2.07, 0.59) and WAZ ( $\beta=-0.63$ , 95% CI: -1.71, 0.47) score declined as average baseline HSCL score increased. The estimates for the effects of change in symptoms over time were negligible for HAZ ( $\beta=-0.01$ , 95% CI: -0.27, 0.25) and WAZ ( $\beta=0.13$ , 95% CI: -0.17, 0.43). Higher average caregiver baseline HSCL scores were associated with lower CD4 cell count ( $\beta=-122.71$ , 95% CI: -568.63, 323.21) as was an increase in average HSCL scores over time ( $\beta=-102.91$ , 95% CI: -327.95, 122.13), but the effects were not statistically significant. Higher average HSCL scores at baseline were however associated with a statistically significant increase in log viral load ( $\beta=2.11$ , 95% CI: 0.06, 4.17), and an increase in average HSCL scores over time with a non-significant reduction in log viral load ( $\beta=-0.72$ , 95% CI: -1.55, 0.12)

**Caregiver symptom chronicity:** Table 4.3 presents the results of the exploratory multivariate regression models with chronicity of HSCL symptoms as a predictor of child growth and HIV-severity outcomes at 24-month follow-up, controlling for caregiver and child characteristics. Children of caregivers who were defined as having episodic HSCL symptoms over the study period on average had a lower HAZ ( $\beta=-0.26$ , 95% CI: -1.52, 1.00), higher viral load ( $\beta=0.90$ , 95% CI: -1.77, 3.57), and higher CD4 cell count ( $\beta=174.06$ , 95% CI: -344.34, 692.46) compared to children of caregivers categorized as having consistently low HSCL symptoms, though none of these differences reached

statistical significance. The reduction in child WAZ associated with episodic caregiver HSCL symptoms relative to consistently low symptoms was negligible ( $\beta=-0.01$ , 95% CI: -1.04, 1.02). The differences between children of caregivers with chronic symptoms compared to consistently low symptoms were meaningfully stronger across all outcomes but not statistically significant (see Table 4.3).

**Table 4.1:** Caregiver and child characteristics at baseline

	<b>Total (n=60)</b>
<i>Child Measures</i>	
Age, mean (sd)	3.34 (0.91)
Male, no (%)	23 (38.33)
Breastfeeding duration (mo's)	15.05 (6.80)
Born on term, no (%)	51 (91.07)
Height for age z-score, mean (sd)	-1.29 (1.88)
Stunted, no (%)	20 (33.33)
Weight for age z-score, mean (sd)	-0.92 (1.51)
Underweight, no (%)	15 (25.00)
Weight for height z-score, mean (sd)	-0.30 (1.39)
Wasted, no (%)	7 (11.67)
Viral load, median (range)	2892 (400, 750,000)
CD4 count, mean (sd)	1452 (817)
<i>Caregiver Measures</i>	
Age, mean (sd)	35.30 (8.50)
Caregiver is child's biological mother, no (%)	46 (76.67)
Non-biological mother HIV-positive, no (%) <sup>*</sup>	3 (25.00)
Language, no (%)	

Dhopadhola	46 (76.67)
Ateso	10 (16.67)
Other	4 (6.67)
Marital status, no (%)	
Single	4 (6.67)
Married	39 (65.00)
Divorced or separated	5 (8.34)
Widowed	12 (20.00)
Education, no (%)	
None	12 (20.00)
At least some primary	37 (61.67)
At least some secondary	11 (18.33)
Wealth index, mean (sd)	-0.03 (0.88)
Average HSCL, mean (sd)	0.83 (0.38)
HSCL chronicity, no (%)**	
Consistently low symptoms	15 (32.61)
Episodic symptoms	13 (28.26)
Chronic symptoms	18 (39.13)

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\* 2 women had an unknown HIV-status at baseline

\*\* Numbers do not sum to 60 due to loss to follow-up as this is a composite variable based on HSCL scores from all four time points



**Table 4.2:** Association of average caregiver HSCL symptom scores with child growth and HIV-illness severity (n=60)<sup>1,2</sup>

	Height for age z-score		Weight for age z-score		Viral load (log)		CD4 cell count	
	$\beta$ (SE)	Cohen's d	$\beta$ (SE)	Cohen's d	$\beta$ (SE)	Cohen's d	$\beta$ (SE)	Cohen's d
Baseline HSCL symptoms	-0.74 (0.68)	0.40	-0.63 (0.55)	0.42	2.11 (1.05)*	0.77	-122.71 (227.46)	0.15
Change in HSCL symptoms	-0.01 (0.13)	0.01	0.13 (0.15)	0.09	-0.72 (0.43)	0.26	-102.91 (114.82)	0.13

<sup>1</sup>Results of mixed-effects regression models controlling for child sex, child age, child on ART (yes vs. no), child born on term (yes vs. no), number of months breastfed, wealth group, caregiver education level (any vs. none), caregiver age, caregiver language (Dhopadhola vs. other) caregiver HIV status, married (yes vs. no), and sub-county; <sup>2</sup>\*p<0.05.

**Table 4.3:** Association of chronicity of caregiver HSCL symptoms with child growth and HIV-illness severity at 24-months (n=60) <sup>1,2</sup>

	Height for age z-score $\beta$ (SE)	Weight for age z-score $\beta$ (SE)	Viral load (log) $\beta$ (SE)	CD4 cell count $\beta$ (SE)
Consistently low HSCL symptoms	Ref	Ref	Ref	Ref
Episodic HSCL symptoms	-0.26 (0.61)	-0.01 (0.50)	0.90 (1.29)	174.06 (250.86)
Chronic HSCL symptoms	-0.90 (0.67)	-0.67 (0.54)	2.17 (1.43)	336.70 (242.43)

<sup>1</sup>Results of linear regression models controlling for child sex, child age, child on ART (yes vs. no), child born on term (yes vs. no), number of months breastfed, wealth group, caregiver education level (any vs. none), caregiver age, caregiver language (Dhopadhola vs. other), caregiver HIV status, married (yes vs. no), and sub-county; <sup>2</sup>\*p<0.05.

## 4.5 Discussion

In this sample of young HIV-infected children, caregiver symptoms of depression and anxiety at study baseline were associated with lower HAZ and WAZ in children followed for two years. Although these associations were not statistically significant, the effects were borderline moderate in size. The impact of change in symptoms over this period on child growth was minimal and non-significant. In general, there was a non-significant dose-response relationship between the chronicity of depression and anxiety symptoms and child growth in the expected direction.

Caregiver symptoms of depression and anxiety at study baseline, but not change in symptoms over time, were significantly associated with higher viral load in children. Further, there was a substantial but non-significant dose response relationship between chronicity of depression and anxiety symptoms and viral load in exploratory analyses. Depression has been shown to impact adults' own adherence to ART (48–50); a recent trial of cognitive behavioral therapy for depression in the U.S. showed those receiving cognitive behavioral therapy to exhibit significantly better adherence to ART than controls (49). In Uganda specifically, two studies have found an association between worse ART adherence and depression (51,52). As successful HIV-treatment for children depends on a functional caregiver to ensure a child receives and/or adheres to ART, caregiver mental health support may be an important component to include in HIV-services. CD4 cell count also exhibited a non-significant dose response relationship with caregiver symptom chronicity, but not in the hypothesized direction. This relationship did not reach statistical significance, but the increase in CD4 cell count associated with

chronically symptomatic caregivers was twice that of episodically symptomatic caregivers. The unexpected directionality of this association could be due to the high degree of variability in child CD4 cell count and the rapid changes that children undergo in CD4 cell count as a part of healthy development.

Our findings on child growth are consistent with other studies of the effect of maternal or caregiver depression and anxiety symptoms in samples that included a substantial number of HIV-infected mothers or children, which have reported mixed or null results (18,20). A longitudinal study conducted in a high HIV-prevalence country (South Africa) that did not specify the HIV status of participants also found limited effects of maternal depression on child growth (53). The pattern of chronic symptoms being more predictive of poor growth outcomes was also consistent with a recent study in Tanzania which found that cumulative depression was associated with a small increase in the risk of a child being wasted or underweight (20). Lack of statistically significant findings in analyses of chronicity may have been due to low power. A post-hoc power analysis indicated that our achieved power ranged from 50% to 75% across outcomes; thus, the results from that analysis should be interpreted as exploratory. The differences in child growth outcomes in these analyses however are substantial, and indicate this is a relationship that merits further investigation.

Several factors may have also contributed to the lack of statistically significant findings regarding the effects of worsening caregiver depression and anxiety over time. With the majority of studies on maternal depression and child growth conducted in families unaffected by HIV, it is possible that the socioeconomic and biological effects of

HIV-illness outweighed the effects of caregiver symptoms. Further, the majority of studies on the relationship of maternal mental health and child growth have been done among infants or children under the age of two years (26). Although the period from two years to middle childhood can be a critical time for catching up on growth (22), it is possible that the effects of depression and anxiety on child growth are attenuated in this less sensitive developmental period in which vulnerability to morbidity and mortality decreases and as children become less fully dependent on their caregivers. Our caregivers were also not sampled from a population seeking mental health assistance and only one third of caregivers reported experiencing high depression and anxiety symptoms (defined as an HSCL score greater than 1) at baseline. Caregivers in this sample were connected to HIV-treatment providers, engaging in biweekly health and nutrition trainings as a part of participating in the TAU arm of the parent RCT, and receiving nutritional supplementation. The potential benefits of these services may have overshadowed the potentially harmful effects of caregiver depression and anxiety.

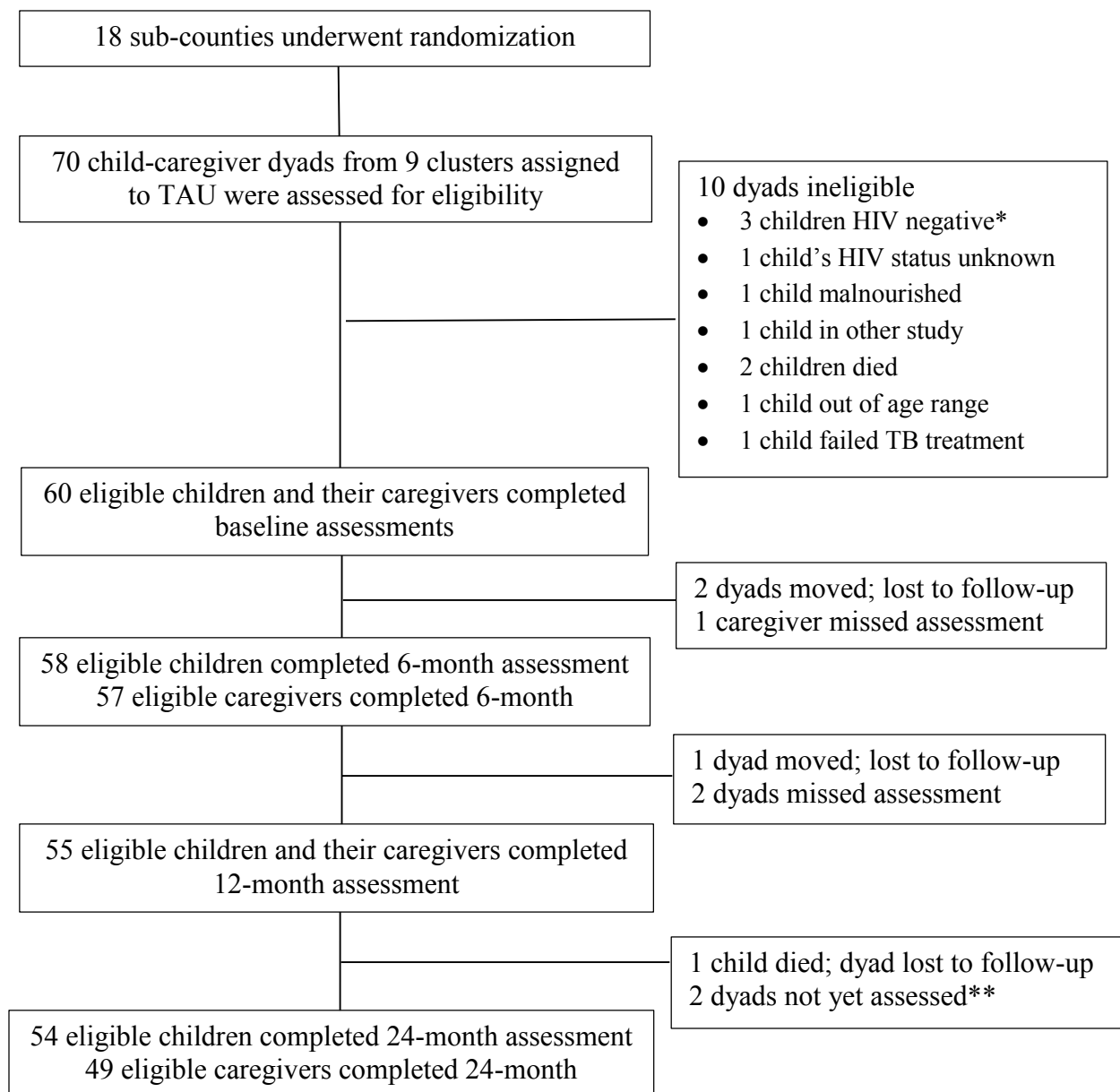
Our findings should be interpreted in the light of several limitations. As this was a secondary data analysis, we did not have information on caregiver symptoms of mental distress in the prenatal or infant period nor did we have information on children's growth from birth to enrollment. We were also not able to control for a child's birth weight as many caregivers did not have or know this information about their child. Therefore, we cannot isolate the full impact of caregiver mental health on child growth through early childhood but rather are limited to reporting on the effect of caregiver depression and anxiety symptoms during this time period as one potential factor influencing child growth and HIV-severity. While many studies on this topic use a binary outcome of stunted or

underweight status, we were unable to do this due to our limited sample size. Further, since our sample was engaged in HIV-care and health trainings, engagement in these services could have had a protective effect on both caregiver mental health and on the child outcomes.

## 4.6 Conclusions

Our findings are suggestive that caregiver symptoms of depression and anxiety outside of infancy may still have limited effects in HIV-affected families on child growth and physical health, particularly among chronically symptomatic caregivers. Given that our sample was engaged in ongoing care, these results may help to understand sources of variability in outcomes for children enrolled in standard services. Given elevated rates of mental distress in HIV-infected caregivers and malnutrition among HIV-infected children, further studies are needed to clarify if the same relationship observed in non HIV-affected populations holds in HIV-affected populations, and if not, why mechanisms of the relationship may vary.

**Figure 4.1:** Participant screening and follow-up



\*Two of these three children were enrolled in the HIV-infected cohort but were later found to be negative, at which point they were moved to the study's HIV-exposed cohort.

\*\*These dyads were enrolled later in time as a part of the HIV-exposed cohort but were found to be positive during the course of the study and moved to the HIV-infected cohort.

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## **Chapter 5: Caregiver understandings of their mental health and child-wellness: a qualitative investigation among HIV-affected families in Uganda**

### **5.1 Abstract**

Prior studies have indicated that maternal depression has a substantial impact on early child growth, development, and health. Much of the research on this topic in low-income countries has relied on cross-sectional data, has given limited consideration to the context in which the relationship occurs, and has not considered the potential impact of child sickness on parental mental health. Based on semi-structured in-depth interviews with Ugandan caregivers of HIV-infected children expressing elevated mental health symptoms and with their health trainers, we sought to create a contextually informed conceptual framework based on the perspectives of women with lived experience of the relationship between caregiver mental health and child well-being. Caregivers described their role in raising healthy children as a complex task made difficult by poverty, stigma, and social isolation. While caregivers described an impact of their own mental health on child well-being, the effects were primarily discussed as emotional and behavioral. Caregivers also discussed the ways in which caring for a child could bring distress, particularly when children were sick and they were unable to provide the care they desired to give. Our findings suggest that it is warranted to investigate the reciprocal effects of child sickness on caregiver well-being and that child health programs should holistically address poverty, mental health, and stigma among HIV-affected women.

## 5.2 Introduction

Depression and anxiety are prevalent among women in low-income countries (1–4) and has intergenerational effects. Maternal depression has been shown to negatively impact child socio-emotional, cognitive, and physical development (5–8). Based on two longitudinal studies, children of depressed versus non-depressed mothers were found to have twice the odds of being underweight and stunted (8). Potential mechanisms of this relationship include maternal functional impairment (9,10), reduced stimulation in a child's environment (11), early cessation of breastfeeding (12), and poor mother-child attachment (13,14). Maternal depressive symptoms have also been linked to infectious disease in children such as febrile and diarrheal illnesses (15,16).

Many studies on the relationship between maternal depression and child health are cross-sectional (8,17) and the potential impact of child illness or poor growth on caregiver mental health is less often explored. Much of the literature that exists on this reciprocal relationship is limited to high-resource settings, specifically English-speaking, white families (18). In terms of child growth, mothers of very low birth weight infants in the U.S. experienced greater mental distress after birth than mothers of non-low birth weight children, and mothers of high-risk low birth weight infants had continued greater risk of poor mental health over two years (19).

Another limitation of the current literature is that the relationship between maternal mental health and child growth or health has not been widely explored in HIV-affected families (20–22). Mental disorders are common among people living with HIV/AIDS (PLWHA) (23–25) and poor mental health has been shown to affect the

quality of life (26) and overall health (27,28) of PLWHA. Further, children of HIV-positive mothers are at particular risk of poor growth (29). Research demonstrating heightened economic impacts of illness (30), the importance of stigma (31), and a differential relationship of social support to mental health (32) in HIV-affected families points to the need for exploration of contextual factors that may be important in understanding the lived experience of caregivers and children affected by HIV.

With under-nutrition in mothers and children responsible for an estimated 35% of morbidity in children under five and 3.5 million deaths globally (33), understanding the relationship between maternal depression and anxiety symptoms and child growth and health is a public health priority. Based on the limitations of prior studies on the topic of maternal depression and child health, this study aims to develop a conceptual framework of the relationship between caregiver mental health and HIV-infected child well-being based on caregivers' own understandings. By using a qualitative approach, rather than controlling for contextual factors in which women care for sick and growth impaired children as covariates, we aim to provide an in-depth insider's perspective that can inform more appropriate and effective support services for families affected by HIV.

## 5.3 Methods

### *5.3.1 Participants and eligibility*

Study participants were caregivers of young HIV-infected children enrolled in the treatment as usual (TAU) arm of a randomized controlled trial (RCT) of a parenting skills intervention. RCT recruitment occurred between March 2012 and November 2013

through local clinics and NGOs providing HIV care in two rural districts of eastern Uganda. To be eligible for the trial, caregivers had to be female, caring for the potential study child the majority of the time, and able to participate in a year-long program. Accordingly, women with a severe mental illness or disability were excluded. In the RCT data was collected at baseline, 6-months, 12-months, and 24-months. Measures included a child physical exam, a demographic questionnaire, the Hopkins Symptom Checklist for depression and anxiety (HSCL-25) (34,35), an adaptation of the Multidimensional Scale for Perceived Social Support (MSPSS) (36,37), and an inventory of coping strategies for caregivers. Women in this arm received 12 months of biweekly health training in which trainers provided basic information on nutrition, hygiene, and living with HIV, as well as a ready mix porridge supplement.

Of the 60 caregivers of HIV-infected children enrolled in the TAU arm of the RCT, we sampled nine women for this qualitative study who were in, or had just completed, a 12-month maintenance period following training. Sampling was purposive using data collected during the RCT. We selected women who had an HSCL-25 score above the sample mean at least once during follow-up and sampled to achieve maximum variation on child health outcomes (height for age, weight for age and weight for height). All women spoke either Dhopadhola or Ateso, most were HIV-positive, seven were the study child's biological mother, and six were married. The age range of caregivers in our sample at the RCT baseline was 23-45 years. In addition, four study staff (three women and one man) who provided training to participants in the TAU arm were selected for interviews.

### *5.3.2 Procedures*

We created an open-ended interview guide used to conduct 20 semi-structured in-depth interviews (IDIs) with caregivers and TAU trainers over a three-week period in August 2014. The guide broadly covered the following topics: contributors to child health and poor growth, the qualities of caregivers of a healthy child, caregiver experiences with child illness, and how problems faced by caregivers affect children. Seven out of nine caregivers were interviewed twice. Four Ugandan qualitative interviewers, who were either currently enrolled in undergraduate studies or had completed their Bachelor's degree, conducted IDIs with caregivers in either Dhopadhola or Ateso. SM and IF interviewed trainers in English. Interviewers worked in pairs with one person conducting the interview and taking notes and the other solely transcribing the interview. The two interviewers sat down together and reviewed their notes immediately following the interview and wrote up the final transcript together. Notes were taken in English due to the difficulty interviewers had writing quickly in the local language with the exception of key terms or words that could not be readily translated. As only one interviewer spoke Ateso well enough to be comfortable interviewing and taking notes, transcripts from the two Ateso speaking participants were based on the notes of one interviewer. Caregivers were interviewed in a quiet, private location chosen by them, typically their own homes. Trainers were interviewed at the study office. Interviews were limited to an hour or less.

### *5.3.3 Ethics*

Study participants were initially contacted by Global Health Uganda (the local implementing partner) to see if they were interested in participating in the qualitative

study. If given permission, interviewers traveled to women's home to discuss the study and conduct oral informed consent. Informed consent emphasized that participation was voluntary and that the choice to participate or not would not impact participation in the broader trial. The Michigan State Institutional Review Board and Makerere University's School of Medicine Research and Ethics Committee provided ethical approval.

#### *5.3.4 Data analysis*

SM and a post-doctoral fellow met daily with interviewers to debrief on challenges and emerging themes. Drawing on elements of grounded theory (38), the analysis began by re-reading transcripts and using line-by-line coding on all 16 caregiver interviews to develop emergent themes using Nvivo software (39). All 20 transcripts were then reviewed with a questionnaire that contained codes for emergent and two *a priori* themes (effect of caregiver mental health on child and effect of child on caregiver mental health). Quotes were selected based on how illustrative they were of study themes, with particular attention to quotes from different caregivers that represented or tied themes together with thick description. Selected quotes were reviewed within the full transcript to check interpretation. To provide additional context, two case study narratives were developed by reviewing quantitative and qualitative data (including coding, themes, and memos written by the author) provided by caregivers (40). Cases were chosen to be paradigmatic of developed themes while presenting diverse experiences.

### **5.4 Results**

The conceptual model of the relationship between caregiver mental health and HIV-infected child physical health developed based on caregiver interviews is detailed in

Figure 1. In the following, we start by describing how women understood their role in raising a healthy child (“you have to struggle to provide”) and then focus mostly on describing the pathways between caregiver mental health and child well-being described by caregivers. This includes the overall effect of caregiver health on child well-being (“they also suffer”) and the overall impact of child ill health on caregiver’s lives (“it is like you are the one who is sick”). In addition, we highlight a potential mechanism of the interrelationship described by caregivers: the inability to be able to care adequately for a child in sickness and health and how it can affect caregiver mental health and wellness (“asking yourself many questions without answers”). We also discuss the potential role of social support in this process (“I’m just alone as you see me”).

#### *5.4.1 “You have to struggle to survive:” Fulfilling the role of caregiver*

Women described multiple caregiving practices as essential to having healthy children including keeping children and their environment clean, encouraging play and limiting work, teaching and listening to children, and making them feel loved. Several explained that failures to “keep your child well” in these ways leads to sickness. The caregiving duty most discussed in relation to growth was ensuring a child eats well. This complex activity included feeding children a sufficient, varied diet at appropriate times.

Caregivers most commonly described poverty as limiting their ability to meet the demands of parenthood. Their own sickness was described as interfering with their role and exacerbating poverty.

When I was not sick, I could dig and have much food in all seasons that I could eat and even give out some food to other people like the neighbors. I could work and get

some money that could really help me with my children.... But now that I'm sick, with the drugs I'm taking, sometimes it makes me weak and I can't do all this work. The child can also be worried because he will know that: "My parent is sick". And the child will not feel well. -*Agnes*

#### 5.4.2 *"They also suffer:" Caregiver understandings of how their mental health affects children*

Caregivers described that children perceive changes in the family related to sickness and caregiver distress. Failures to provide were said to make children "think a lot," "feel abandoned," and "not loved." Multiple caregivers expressed that when they are sick or distressed, children also suffer, the caregiver's symptoms becoming the child's. When asked how "having many thoughts" affects children, Esther explained:

They are sad because they can also tell when you are happy and when you are not happy. Like when a child returns from school, finds you home and greets you, "How are you grandmother?" Then you keep quiet without answering. They feel sad too. Even when food is ready and you refuse to eat, they can also refuse to eat, or they eat but will not be satisfied.

As can be seen in this quote, caregiver problems were said to also impact children's behavior, for instance making them not want to play. Additionally, mental and physical health were described as connected; an example was that children who "overthink can grow thin." Women explained that stressed caregivers might engage in harmful caregiving practices such as shouting. One trainer echoed this, saying caregivers could become withdrawn from children or aggressive when depressed:

When they are depressed, they don't want to be with the child playing. They mostly want to be alone or doing something. Also it affects the kid's education



because they will be traumatized and say “Mommy is not well, not herself.” Some of the bolder kids even ask what is wrong with the mother. And even the feeding, the nutrition that we train them on, if the mother is depressed she will not remember to cook. Food will not be ready, because she was sitting around alone.

#### *5.4.3 “When the child is sick, it’s like you are the one who is sick:” How child sickness affects caregivers’ lives*

Child sickness, by placing additional burden on the caregiver and depleting resources, was also described as an obstacle to being able to provide. Caring for a sick child was described as a complicated process that included taking children to health providers, procuring medicine, preparing home remedies, ensuring medicine was taken appropriately, and monitoring the child. Mary explains that when her children are sick:

You think a lot, for instance if you have even lost one to death, you think this one will also die. This just makes your brain confused, like you want to run mad. You are not settled in one place, you move from one place to another looking for how to treat your child... You try the clinics in the village. When this fails, you are forced to go to the health center and sometimes sickness increases and you have to run to the main hospital in town. Others resolve to go even to traditional medicine men. You see you get confused and sometimes you even do not have money so you have to look for money around.

Caregivers had to navigate these challenges while dealing with the stress and emotion that comes with seeing their child ill. They described an array of symptoms resulting from their child becoming sick, most predominantly worry or *ka paro teki teki* (over thinking or having too many thoughts). Ethel explained that with an ill child:

You start thinking a lot, and this makes you want to be sick and you don’t even know whether the child will survive. It gives me pressure. It brings pressure

because it brings a lot of thoughts in my head. It makes my heart beat a lot, even if I'm fine myself, the temperature is raising and eventually I can feel sick.

Caregivers also linked crying and feeling *kumo* (sorrow) or pain in the heart to child sickness and thinking too much.

Poverty and limited resources meant caregivers struggled to buy drugs, transport children to care, and stay at clinics with a child, often having to borrow money or sell off crops. The process of seeking care was also described as keeping a woman from earning money and growing food. Immaculate described this by saying that when a child is sick, "*ogoye gima katho malo*" (nothing can continue or all that you are doing stops).

#### 5.4.4 "*Asking yourself many questions without answers:*" *Mental health and the inability to provide*

These quotes also highlight that the inability to perform their duties as caregivers caused distress. When asked how child sickness affected her life, Fiona explained:

*Iturie yo* (worrying over), thinking of what could be paining the child. You may need to take the child to the hospital and yet you do not have any money. That is when thoughts come your way. A child may need to eat something like *mandazi* (fried cakes), especially when they are sick and if it happens that you have a spirit for theft you can even steal to give your child what he wants. If you have many thoughts your life cannot be fine. You even move while absent minded and you can even develop ulcers if you take days without eating you can also fall sick. For us who are HIV-positive, if you have many thoughts your *askari* (white blood cells) reduce and you may die quickly.

This stress was not only limited to times of emergencies or sickness.

I feel sad because of many thoughts. These thoughts come when school time reaches and I start thinking of where to get money because my children are very bright that leaving them to stay at home is not good. I will be wasting them if I left them at home. You even lose sleep every night you are just awake thinking and asking yourself many questions without answers. *–Esther*

Caregivers described a cycle, by which child sickness and caregiver distress interacted to exacerbate poverty. In the face of many barriers, running around trying to help a child, and employing many strategies to try to provide, ultimately some caregivers describe feeling confused or coming to a place of feeling like there is nothing that can be done.

### **Case study 1: Ethel**

Ethel is a mother in her early 20s, living with HIV and caring for multiple children. Her little girl, Alowo, was 2 years old when they enrolled in the parent RCT together. Previously widowed, Ethel found a new partner who also passed away. Describing herself as both mother and father to her children, Ethel worked to grow food on her own but has difficulty getting a good yield of crops on her small parcel of land. At times, the family would not have enough food. Refusing to steal from others, on these days the family would go to sleep hungry.

Alowo repeatedly got sick with malaria during the study. Alowo's fever would come on quickly and Ethel would worry whether or not she would survive. Ethel described having no money at times to buy medicine or take her to a private clinic, so she would take her to the hospital where treatment was free. However, not every drug was always available there and transportation was a challenge. Ethel described once having to beg a neighbor to allow her to borrow a bicycle just to get Alowo there. She struggled to get Alowo to eat when sick. During these times, Alowo would ask for "good food" like meat and rice that Ethel couldn't afford now that her husband was gone. The hospital would tell her too that the child needed to eat better, but Ethel felt at a loss for how to make this possible. Though the brother of her late husband lived nearby, he would not help in situations where they did not have enough food, when he would hear children were sick, or when he would see the poor condition of their house. Her own relatives were either too old to help or themselves were struggling to provide for their own families.

Ethel experienced a high level of depression and anxiety symptoms at the beginning of the study that lessened, but again returned. In particular, Ethel reported having pain in her heart, many thoughts, and feeling fearful, sad, tense, and like everything was hard. She described that her children being sick and her struggle to try to care for them with limited resources would make her feel helpless and bring on some of these symptoms like having too many thoughts. In addition, she had physical symptoms such as feeling low in energy or faint as well as experiencing a racing heart, poor appetite, and headaches. She described that when she would be plagued by many thoughts, she could feel herself grow sick, even feverish. Being sick and at times bedridden made it even harder for her to dig to provide food for her children. She felt when she was sick her children would worry and wonder if she too might die.

Despite all these challenges, Ethel is resourceful and tried many different coping strategies to deal with her situation. She used work sometimes to distract herself from difficult things in life or turned to prayer or religious scripture. She shared her feelings or problems with friends, like when her child was sick. They gave her support, encouraging her to be strong for her children. Indeed, Ethel felt she understood her children's needs and as their mother worked very hard to make sure they had food and treatment when ill despite an incredibly difficult situation, dedicating all her time to them. Ultimately, though Alowo was stunted and severely underweight early on, she caught up in growth over time and was not malnourished at the end of the study. She also started on ARVs and Ethel said after this her health generally improved.

#### 5.4.5 *“I’m just alone as you see me:” The duality of support and isolation*

Women described a variety of sources and types of support in meeting their roles. Having a supportive network of family was seen as important by trainers as well. For instance, families might provide instrumental support by giving money, food, or even keeping children at their homes during difficult times. Several caregivers described family members specifically helping when a child was sick. Neighbors, friends, the church, and local NGOs were also important sources of support, including emotional support during times of distress.

However, many women described feeling isolated and alone in their lives and in their role as caregiver. Even in cases where women described receiving tangible support, caregivers saw themselves as on their own in their responsibilities and that they were the ones who could provide the best care. Both women and trainers explained that family could be a source of conflict and stigma, even if some members were supportive. One trainer explained that women could experience internal stigma because of HIV that caused them to withdraw, while women who accepted and disclosed their status would be verbally abused, something echoed by women. Widows in particular were seen as vulnerable to this. Child misbehavior, described as related to failures to provide, was also said to influence support networks by creating quarrels among adults in the household and fights with neighbors.

## Case study 2: Fiona

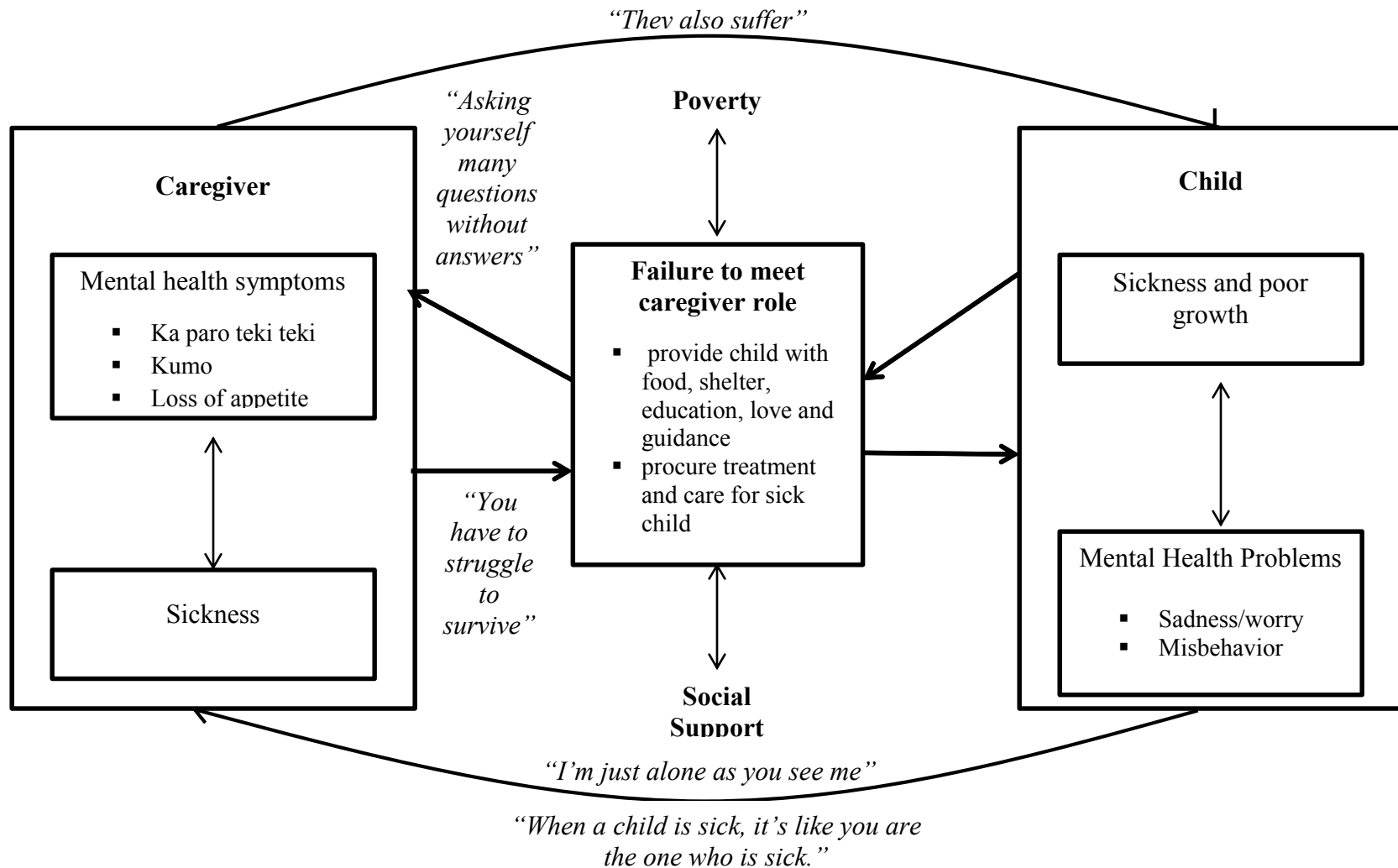
Fiona was a widow in her 30s living with HIV when she and her child (Moses) began participating in the RCT. As the only adult in her household, she also cared for two other children while still living in her former husband's community. The family was poor relative to others in the study and had no cows or goats to supplement their income. Their situation did improve some over time; for instance, she was eventually able to get iron sheets to replace her thatch roof.

Moses began taking ARVs (*ekeya*) when he was 2 years old. Fiona described always giving him his medicine twice a day, though she was concerned that she sometimes could not provide Moses with the food he wanted when taking his *ekeya*. Throughout the study, Moses had an undetectable viral load. His growth was normal for his age, which Fiona noticed to be the case ever since he began *ekeya*. Fiona did describe that he would intermittently develop fever, especially when the family did not have enough good food to eat. She used cool clothes and made home remedies that her trainer taught her to help Moses during these times. If he did not improve, she borrowed money when necessary to take him to the local health center. She even had a nurse's number there whom she could call to get advice or medicine. Once during the study Moses had to be hospitalized for severe malaria. Fiona described the doctor as being unhappy with her because the child was near death, though Moses thankfully recovered.

Fiona experienced intermittent symptoms of depression and anxiety throughout her time in the study. In particular, she often began to cry easily, was worried with many thoughts, and felt hopeless, lonely, or like everything in life was hard. At times these symptoms were very severe. Though she reported being able to function well in her daily life, she did sometimes lose her appetite and have difficulty sleeping. She said when she felt like this her children would feel bad too, worrying about her and knowing things would be different if their father was alive. It could even bring them to not eat. She described the source of her troubling thoughts as worrying about her children when they were sick and how she would provide them care without money, but also worrying about how she would provide for their other needs like school fees. In addition, she said sometimes others would abuse her for taking *ekeya* or she would quarrel with her in-laws. During these quarrels, Fiona said that they would tell her terrible things like that she was responsible for her husband's death. Fiona described that talking to people like her friends helped her during these sad times. She also commonly used her religion as a source of support, engaging in prayer or drawing on scripture.

Despite the distress some family members could cause her, Fiona also discussed that family could be a source of both financial and emotional support. Her brother purchased a cell phone for her that she could use to call him when the child was sick and then he would help take the child to the hospital. Her mom would bring food to sick children and both would keep the child during holidays. Her brother who had income from selling extra crops would buy clothes and both would play with and care for the child, though Fiona emphasized that no one could care for a child as well as a mother. Overall, Fiona's story illustrates the resilience of caregivers and children affected by HIV and how family can be a source of both stigma and strength.

**Figure 5.1:** The relationship between maternal mental health and child well-being described by caregivers



## 5.5 Discussion

As can be seen in Figure 5.1, mental health and physical health were described as interrelated by caregivers. Caregivers understood their mental health as having an influence on child well-being, but mostly discussed the direct effects of their distress as emotional and behavioral. Distress and sickness were linked to being unable to meet the demands of caregiving, related to and exacerbated by poverty as demonstrated in Ethel's case. Importantly, caregivers also discussed the multifaceted effects of child sickness on their lives, including their mental health, their resources, and their ability to earn money. The financial impact of child sickness on households discussed by caregivers has been quantitatively demonstrated in Bangladesh: 75% of families of children hospitalized for pneumonia reported having to borrow or sell possessions mostly in the informal sector and approximately half reported needing to cut spending on food and education for their children to compensate (41).

A major theme emerging from the data was that failure to provide for children was described as a great source of worry and sadness. Caregivers struggled to meet the complex demands of providing for children in times of sickness and in health, enlisting beneficial support from others when possible. Thurman et al. found that while it did not predict a person's psychological state, there were positive benefits for women and their children affected by HIV who participated in support groups (42). Yet, social networks could also be a source of stigma and strife, and many caregivers felt alone in their role as parent and provider. In a study of caregivers of disabled children in Uganda, while men



held control of money and decision-making, women were the ones ultimately responsible for caring for children, consistent with the feeling women described in our study (43).

Our findings are consistent with studies from South Africa, where 40% of caregivers of orphans indicated a high level of caregiving burden that included feelings of stress, anger, and inadequacy in being able to provide. Important predictors of caregiving burden were low income, food insecurity, and the caregiver themselves having an AIDS-related illness (44). In addition, caregivers of AIDS or non-AIDS related orphans were more likely to express depression and female sex and food insecurity were associated with a higher prevalence of depression while greater access to resources was protective (45). Moreover, the relationship between caregiver and child well-being described by women in our study is consistent with two of the four models proposed by Wachs (46) linking malnutrition and mental health among mothers and children. The *multiple risks* model emphasizes the mutual relationship between malnutrition and life stressors. Wachs points particularly to reduced coping, but women describe the way malnutrition and sickness creates additional stressors. The *cross-generational* model suggests that mother-child interactions are disturbed when a mother is malnourished. In our study, women described sickness and distress caused by either their own poor health or their child's as disturbing their ability to interact with and care for their children.

The two case studies demonstrate the range of experiences of women caring for HIV-infected children while coping with depression and anxiety. Both women worked hard to provide for their children and care for them when sick despite dealing with their own illness, the loss of a spouse, and limited resources. Fiona's case in particular shows

that while family may engage in stigmatizing behaviors, family members can also be a source of both instrumental and emotional support for caregivers. Further, children may thrive physically despite a range of potential environmental insults, or in Ethel's case, improve over time.

This study should be interpreted in light of several limitations. Due to the busy lives of the participants, it was common for interviewers to find women tired or distracted by other duties during interviews. We dealt with this challenge by keeping interviews to an hour or less, rescheduling, and conducting second interviews when necessary. Further, caregivers and trainers may have shared or not shared certain information with interviewers due to their perceived association with the larger RCT. We emphasized in informed consent that interviews would not affect women's participation in the RCT or trainers' jobs. We also hired staff from outside the organization running the trial to interview caregivers. SM, who works outside the local organization's staffing structure and holds no authority over staff employment, interviewed TAU trainers. As we did not audio record interviews and interviewers were limited in their ability to write quickly in the local language, transcripts may have been incomplete. We tried to minimize this possibility by having interviewers work in pairs, both diligently taking notes during interviews and finalizing transcripts together. Transcription this way was faster in this context allowing for quicker discussion, review, and opportunity for iteration. Nonetheless, some of the themes emerging from interviews warrant further investigation; due to the study time frame, we were limited in the amount of iteration we could perform in relation to these themes. Strengths of the study include triangulation of sources, the

ability to utilize quantitative data collected over time to purposively sample women, and iteration over multiple interviews with women.

## 5.6 Conclusions

Caregivers and trainers described a complicated and contextualized relationship between the well-being of women and their children. Future investigation should focus on the reciprocal impacts of child sickness on caregiver mental health and household economics. Self-efficacy and inability to perform caregiver duties due to poverty, functional impairment, and isolation should be assessed further as mediators of a bidirectional relationship between caregiver and child well-being. Our findings also suggest that pediatric care should screen for caregiver mental health problems, not only to potentially improve child physical, social, and emotional well-being, but also to help identify women who may need assistance in coping with the stress of child sickness. Poverty reduction and anti-stigma programs to improve access to resources and social support are likely an important compliment to health programs for HIV-affected families.

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## **Chapter 6. The interrelationship between caregiver mental health and the growth of HIV-infected children in Uganda: a cross-lagged panel analysis**

### **6.1 Abstract**

Recent research has demonstrated a substantial link between maternal depression and child malnutrition. Due to the cross-sectional design of many studies on this topic, the causal nature of this relationship is not fully understood. Using a cross-lagged panel approach to analyze data from 60 caregivers and their HIV-infected children in Uganda, this study aimed to clarify the directionality and relative magnitude of associations between caregiver distress (depression and anxiety symptoms) and child growth (height for age and weight for age) over a period of two years. Lagged caregiver depression and anxiety symptoms significantly predicted lower weight for age at 12-months ( $\beta=-0.142$ ,  $p\text{-value}=0.011$ ) and 24-months ( $\beta=-0.171$ ,  $p\text{-value}=0.010$ ) but not height for age. Lagged height for age ( $\beta=-0.275$ ,  $p\text{-value}=0.004$ ) and weight for age ( $\beta=-0.275$ ,  $p\text{-value}=0.008$ ) predicted caregiver depression and anxiety at 24-months, but effects at 12-months were small and non-significant. These exploratory results suggest that caregiver depression and anxiety may not only predict poor growth in children, but that a failure to thrive in children may have important ramifications for caregiver mental health. More studies are needed that explore the reciprocal impact of child health on caregiver well-being, in order to inform more holistic and effective maternal and child health programs.

## 6.2 Introduction

Mental, neurological and substance use disorders are the fifth leading cause of disease burden globally, with depressive and anxiety disorders accounting for over half of the disability adjusted life years (DALYs) associated with this group of conditions (1). The burden of depression and anxiety is estimated to be 50% greater among women as compared to men (2). With the DALYs associated with mental disorders having increased by 38% over the past two decades (3), depression and anxiety are increasingly important health concerns globally, including in low-income and middle-income countries (LMIC).

Depression can have a detrimental impact on women's health by increasing the likelihood of pregnancy related complications, poor health behaviors, functional impairment, and suicidal ideation or attempts (4). Although there is mixed evidence as to whether HIV-infection is associated with a greater likelihood of depression or anxiety among sub-Saharan African women, depression and anxiety are common in this population (5–8). In Malawi where HIV-positive and HIV-negative women were found to have a similar prevalence of depression, depression was twice as prevalent among women who had transmitted HIV to a child, with over a third of mothers who were identified as depressed experiencing their symptoms during the postpartum period (8). Further, poor mental health in people living with HIV has been shown to be associated with increased stigma (9), poorer rated quality of life and overall health (10–12), and disease progression (13).

Among women in LMIC, common maternal mental disorders (predominantly depression and anxiety) have an estimated prevalence of 19.8%, with women who experience intimate partner violence, lack of social support, and poverty at increased risk (14). The effect of maternal

depression on child physical development has been examined widely and linked to low birth weight (15), infectious disease (16,17), and child underweight and stunting (18). By threatening livelihoods and exacerbating poverty (19), HIV-related illness in families can also affect the development of young children (20). HIV-infected children are at increased risk of poor growth (21,22), yet few studies have assessed the impact of poor maternal mental health on HIV-infected child health and findings from studies of HIV-affected children are mixed (23–25).

The population attributable risk of maternal depression associated with child stunting and underweight has been estimated to be in the range of 20-30% (18,26). However, many studies on this topic are cross-sectional, which does not allow for the investigation of a causal relationship between maternal mental health and child growth. Some of the observed association could be a function of reverse causation (i.e. poor child development causing increased maternal depression) (18), but this relationship has seldom been studied in LMIC.

Given the limitations of current research, we aimed to longitudinally assess the interrelationship of the mental health of female caregivers and the growth of their HIV-infected children in Uganda. We hypothesized that (1) greater caregiver anxiety and depression symptoms would predict lower child height for age and weight for age z-scores and (2) lower child height for age and weight for age z-scores would also predict greater caregiver anxiety and depression symptoms throughout two-years of follow-up. By understanding the directionality and relative strength of these relationships, more comprehensive health services can be designed to meet the needs of caregivers and children in HIV-affected families living in LMIC.

## 6.3 Methods

### *6.3.1 Study design and participants*

Data for this secondary analysis were collected from 60 dyads consisting of an HIV-infected child and a female caregiver during participation in the treatment as-usual arm of a randomized controlled trial (RCT) of the Mediation Intervention for Sensitizing Caregivers (MISC) in eastern Uganda. MISC is a year-long caregiving skills intervention designed to impact child neurocognitive development. The treatment-as-usual condition of this RCT consisted of a year of basic health and nutrition training based on a 13-topic curriculum developed by the Uganda Community Based Association for Child Welfare (UCOBAC) for caregivers living with HIV. Ugandan trainers with a university level education delivered the curriculum during biweekly sessions that alternated in location between the caregiver's home and study office. Caregivers also received a locally produced nutritional supplement every month that contained millet, soya, sesame, peanuts, rice and sugar as a part of their participation in the RCT.

Caregiver-child dyads were recruited into the parent RCT from local clinics and non-governmental organizations that provided prevention of mother to child transmission (PMTCT) and HIV-care in the two rural study districts, Tororo and Busia. Dyads were enrolled and caregivers provided written informed consent between March 2012 and November 2013. Trial eligibility included that a child was born to an HIV-infected mother, was between the ages of two and five at enrollment, and did not have a prior illness or injury that could have caused central nervous system damage. Accordingly, any child that experienced serious birth complications, severe malnutrition that required hospitalization, cerebral malaria, bacterial meningitis, or encephalitis was excluded from the study. For caregivers to be eligible, they must

have been residing in one of the two study districts and have been willing and able to participate in the year-long program. Exclusion criteria for caregivers included having a severe mental illness or disability that would prevent active engagement in the study. In the parent RCT, caregiver was defined as the person who reported predominantly caring for the child. While all study caregivers were female, they were not required to be the child's biological mother.

### *6.3.2 Measures*

Caregiver and child measures used in this analysis were administered in-person at three time points: baseline (pre-health training), 12-months (following the end of training), and 24-months. All study instruments were translated into three study languages: Dhopadhola, Ateso, and Luganda. The translation process included independent back translation with reconciliation of differences made by group consensus.

**Child growth:** Child height, weight, and health history were assessed during a physical exam completed by the study nurse or clinical officer. Height was measured in centimeters (cm) to the nearest 0.1 cm using a measuring board and weight was measured in kilograms (kg) to the nearest 0.1 kg on a standing scale. Child growth was operationalized as two variables: height for age z-score (HAZ) and weight for age z-score (WAZ). A HAZ or WAZ score of less than -2 indicates that a child is stunted (indicating long-term undernutrition) or underweight (indicating acute and/or chronic undernutrition) respectively and on both measures a threshold of -3 indicates severity. These measures were standardized using sex and age-specific World Health Organization (WHO) growth curves developed separately for children aged 0-5 (27) and 5-19 (28). HAZ and WAZ scores were analyzed as continuous variables.

**Caregiver mental health symptoms:** Health trainers administered symptom measures at the caregiver's home. Specifically, caregiver depression and anxiety symptoms were measured using the Hopkins Symptoms Checklist-25 (HSCL) (29,30). The HSCL-25 contains 25 symptom questions: 10 that measure anxiety and 15 that measure depression, with participants using a Likert scale of 0 (not at all) to 3 (a lot) to rate how often they experienced each symptom within the last two-weeks. The HSCL has been used to assess depression and anxiety in multiple sub-Saharan African contexts (31–34) including in HIV-affected populations (35,36). The HSCL depression subscale was also previously adapted through qualitative research with HIV-infected adults in rural Uganda and locally validated (37,38) using a process described elsewhere (39). Although the scale was validated in a Luganda speaking population, the HSCL-depression subscale has previously been translated for use in other Luo languages (the family to which Dhopadhola belongs) with good internal consistency (40).

### *6.3.3 Analysis*

Summary statistics, histograms, and boxplots were generated to describe study variables and assess variable distributions. All variables were also carefully assessed for missingness and both patterns and predictors of missingness were explored. A cross-lagged panel analysis was conducted to assess the interrelationship between caregiver mental health and child growth over two years of follow-up. Cross-lagged panel analysis allows for simultaneous estimation of the auto-correlation of each variable throughout follow-up, the synchronous relationships between two variables at each time point, and the lagged associations between two variables over time (41,42). This procedure enables comparisons of the relative strength of the different associations by time and direction. Further, as a form of structural equation modeling, structural and



measurement components can be incorporated into cross-lagged analyses allowing for the appropriate modeling of latent constructs.

Model fit for both the measurement and structural models was assessed using the chi-square goodness of fit test, Comparative Fit Index (CFI) (43), Tucker Lewis Index (TLI) (44,45), and the Root Mean Square Error of Approximation (RMSEA) (46). A CFI and TLI over 0.9 were considered indicative of adequate fit (41). An RMSEA of 0.05 or under was considered excellent fit, 0.06 to 0.08 adequate or mediocre fit, and over 0.1 poor fit (41,46).

**Measurement model development:** Exploratory and confirmatory factor analyses were used to create a measurement model for the latent construct of caregiver mental health. First, an exploratory factor analysis (EFA) with iterated principal factor estimation was conducted on the items of the HSCL-25 at each time point to revise the scale and identify its underlying factor structure. Choice of number of factors was based on theory, the number of eigenvalues over one produced in a principal components analysis, the percentage of additional variance explained by each additional factor, scree plots (47), and a parallel analysis (48). Based on these criteria, a two factor model was suggested to underlie the symptoms at baseline and 12-months and a one factor model at 24-months. However, the two-factor solution with promax rotation over the first two time points did not result in a consistent interpretable second factor. Therefore, a one-factor solution was selected for all time points. In the one-factor solution, four items did not load highly ( $<0.4$ ) on the single factor at any time point and thus were dropped from the scale in subsequent analyses (see Table 6.1). Confirmatory factor analyses (CFA) were then performed on the remaining symptoms to test the measurement model at each time point. As item responses were

categorical, a polychoric correlation structure and weighted least squares estimator was used (49).

To assess for measurement invariance, two longitudinal CFAs were conducted. In the first (the saturated model), item loadings and thresholds were allowed to vary over time; in the second (the nested model), loadings and thresholds of the same item were constrained to equality over time. The constrained nested model was tested against the saturated model using a likelihood ratio test (41,50). Modification indices were used to determine items driving invariance (41) and constrained and unconstrained models were again compared. This iterative process resulted in three additional items being dropped (see Table 6.1). As likelihood ratio tests are sensitive to sample size, we also used the aforementioned goodness of indices to refine the final model (51). One final item, selected based on differences observed in item loadings over time in unconstrained models, was dropped to improve model fit. The final measurement model consisted of 17 items from the HSCL-25 scale (see Table 6.2) with all loadings and thresholds constrained to equality over time. The internal consistency of this modified scale over time was evaluated by calculating Cronbach's alphas at each time point. Cronbach's alpha scores in the 0.7-0.9 range were considered as indicative of adequate to good internal consistency (52,53).

**Structural model:** Once the measurement model was developed, structural components were added to create separate cross-lagged panel models for child HAZ and WAZ. Residual errors were allowed to correlate among the structural and measurement components of the model. To improve model precision, structural paths were constrained to equality. The model constraints included:

- 1) auto-regressive coefficients between caregiver mental health over time;

- 2) auto-regressive coefficients between child growth over time;
- 3) cross-lagged effects of caregiver mental health on child growth; and,
- 4) cross lagged effects of child growth on caregiver mental health;

The change in fit with the addition of each constraint was assessed independently in comparison to a saturated model where all paths were freely estimated with likelihood ratio tests for nested models. If the constrained model did not fit significantly worse ( $p\text{-value} > 0.1$ ), then the constraint was retained. A model with all selected constrained paths included was then tested against the saturated model where all paths were freely estimated.

All models were estimated using weighted least squares means and variance adjusted (WLSMV) estimation. This estimator is optimal for categorical data that violate assumptions of normality (54,55). WLSMV estimation manages missing data through a combination of maximum likelihood and pairwise present deletion approaches (56). Exploratory analyses (including EFAs) were conducted with Stata13 (57). CFAs and structural equation modeling were conducted using Mplus version 7 (58). The Michigan State University Internal Review Board (IRB) and the Makerere University's School of Medicine Research and Ethics Committee in Uganda reviewed and approved the parent RCT.

## 6.4 Results

### *6.4.1 Descriptive statistics*

Descriptive statistics for caregiver mental health and child growth outcomes are displayed in Table 6.2. In general, child HAZ and WAZ improved over time. Caregivers on average experienced an improvement in mental health symptoms at 12-months that was not sustained at

24-months. Cronbach's alphas for the mental health scale were 0.80, 0.87, and 0.90 at baseline, 12-months, and 24-months respectively, indicating stable and adequate reliability over time. At 24-months, 12% of children and 18% of caregivers were lost to follow-up (see Table 6.2).

#### 6.4.2 HAZ

The structural equation model selected for HAZ included auto-regressive paths between caregiver mental health symptoms and cross-lagged paths leading from caregiver mental health symptoms to HAZ constrained to equality over time. Constraining the other set of auto-regressive and cross-lagged paths to equality resulted in poorer model fit and problems in appropriate estimation. The likelihood ratio test of the selected model against a saturated model with all paths freely estimated resulted in a chi-square value of 0.421 and a p-value of 0.8102, indicating that the selected model did not fit significantly worse. The final cross-lagged panel model for HAZ demonstrated good fit overall with the upper limit of the RMSEA confidence interval under 0.5 and a CFI and TLI value greater than 0.9; however, the chi-squared goodness of fit test p-value was  $<0.05$  indicating poor fit (Table 6.3).

The estimated path coefficients of the final cross-lagged model for HAZ are displayed in Figure 6.1. HAZ status was significantly and strongly predictive of HAZ status at the following-time point, but the size of the effect diminished over time (T1 to T2:  $\beta=0.960$ ,  $p\text{-value}<0.001$ ; T2 to T3:  $\beta=0.865$ ,  $p\text{-value}<0.001$ ). Caregiver mental health auto-regressive paths were also significant and stable over time (T1 to T2:  $\beta=0.520$ ,  $p\text{-value}<0.001$ ; T2 to T3:  $\beta=0.562$ ,  $p\text{-value}<0.001$ ). The lagged effects of mental health on HAZ were small and non-significant (T1 to T2:  $\beta=-0.063$   $p\text{-value}=0.253$ ; T2 to T3:  $\beta=-0.066$ ,  $p\text{-value}=0.232$ ). There was a small non-significant effect of HAZ at baseline on caregiver mental health at 12-months (T1 to T2:

$\beta=0.011$ ,  $p\text{-value}=0.927$ ). There was, however, a significant effect of HAZ at 12-months on caregiver mental health at 24-months; a one-unit improvement in child HAZ score at 12-months was associated with a significant -0.275 point reduction in caregiver mental health score at 24-months ( $p\text{-value}=0.004$ ).

#### 6.4.3 WAZ

The structural equation model selected for WAZ included auto-regressive paths between caregiver mental health, auto-regressive paths between WAZ, and cross-lagged paths leading from caregiver mental health to WAZ constrained to equality over time. Constraining the other set of cross-lagged paths (leading from WAZ to caregiver mental health) to equality did not result in a likelihood ratio test  $p\text{-value}$  under 0.05 ( $\chi^2$  value=2.609,  $p\text{-value}=0.1063$ ), indicating the model did not fit significantly worse with this additional constrained path. However, given the difference in the magnitude of the estimated path coefficients by time point (see Figure 6.2), the sensitivity of likelihood ratio tests to sample size, and a lack of significant improvement in model fit indices, it was decided to leave these paths freely estimated for improvements in interpretability and better comparability to the HAZ findings.

The likelihood ratio test of the selected model against a saturated model with all paths freely estimated resulted in a chi-square value of 1.015 and a  $p\text{-value}$  of 0.7975, indicating that the selected model did not fit significantly worse. The final cross-lagged panel model for WAZ demonstrated adequate fit with an RMSEA of 0.033 and the upper limit of the confidence interval below 0.50 (see Table 6.3). The CFI and TLI both indicated adequate fit at a value of 0.909 and 0.910 respectively; however, the chi-squared goodness of fit fell just in the range of significance ( $p=0.0405$ ) indicating relatively poor fit (Table 6.3).

The estimated path coefficients of the final cross-lagged model for WAZ are displayed in Figure 6.2. WAZ status was significantly and strongly predictive of WAZ status at both time points (T1 to T2:  $\beta=0.872$ ,  $p\text{-value}<0.001$ ; T2 to T3:  $\beta=0.696$ ,  $p\text{-value}<0.001$ ). Caregiver mental health auto-regressive paths were also significant and the magnitudes were similar to those estimated in the HAZ model (T1 to T2:  $\beta=0.520$ ,  $p\text{-value}<0.001$ ; T2 to T3:  $\beta=0.565$ ,  $p\text{-value}<0.001$ ). The lagged effects of mental health on WAZ were statistically significant. A one-unit increase in caregiver mental health at the prior time point was associated with a 0.142 reduction in WAZ at 12-months ( $p\text{-value}=0.011$ ) and a 0.171 reduction at 24-months ( $p\text{-value}=0.010$ ). While there was a smaller and non-significant effect of WAZ at baseline on caregiver mental health at 12-months (T1 to T2:  $\beta=-0.067$ ,  $p\text{-value}=0.564$ ), a one-unit improvement in child WAZ score at 12-months was associated with a significant -0.275 unit reduction in caregiver mental health score at 24-months ( $p\text{-value}=0.008$ ).

## 6.5 Discussion

Caregiver mental health was found to have varied impacts on measures of child growth over time. Increases in symptoms were not associated with meaningful or significant decreases in height for age z-scores (HAZ) in children, consistent with another recent longitudinal study of this relationship in HIV-affected east African children (24). However, caregiver mental health was associated with significant but small increases in weight for age z-scores (WAZ) that were stable over the study follow-up period. The difference found in the influence of caregiver mental health by growth outcome may be a product of the sensitivity of the first 24-months of life to stunting and the limited amount of catch-up growth children are able to achieve outside of that time period (59,60). The sample of children included in this study were two years of age or older

at study baseline, which differs from the majority of studies that have found a relationship between caregiver mental health and child stunting (18). Accordingly, the auto-regressive paths for HAZ decreased over time and constraining these paths to equality resulted in significantly worse model fit.

Although younger child age is associated with greater vulnerability to morbidity and mortality, a stronger effect was found for the impact of child growth on caregiver mental health, only during the second half of the study period. Study caregivers experiencing a change in support between the 12- and 24-month assessments when they entered the study maintenance period and were no longer receiving health training may explain this. The social and practical support provided by regularly having someone meet with them may have been protective and overshadowed the impact of poor child growth on caregivers' mental health. Qualitative findings with study caregivers indicated that another possible pathway for the effect of poor child health on caregiver mental health was a feeling of being unable to provide for their child and ensure their well being. In this trial, the caregivers were receiving nutritional supplementation for their children. Thus, the nutritional supplementation may have served as a buffer against feelings of helplessness in caregivers.

These findings should be interpreted in the light of several limitations. An important consideration in cross-lagged panel analyses is the stability of variables over time. Low stability could be due to true changes in the variable or poor reliability. This study did not include reliability testing for the child growth measures over time. However, the same two staff members conducted these measurements at each time point and both HAZ and WAZ had consistent and strong auto-regressive paths over time, strengthening the argument that they are generally

reliable. The reliability of the caregiver mental health scale was high at all time points. Although item-level missingness was limited, data were missing from the analysis due to loss to follow-up. While WLSMV estimation is not solely a full-information estimation, the estimator has been shown to be consistent if data is assumed to be “missing at random with respect to X” (61).

The small study sample size is the largest limitation as it meant adding many covariates to the model could cause the model to be unidentified and adding limited covariates worsened model fit. To help account for shared variance caused by a third variable between caregiver mental health and child growth in the estimation of cross-lagged effects, the covariance between these variables was estimated at baseline and the residuals of these variables at follow-up were allowed to be associated. Given the small sample size of this study, results should be interpreted as exploratory. As this is one of few studies to analyze the relationship of caregiver mental health child growth in HIV-infected children and the first to use cross-lagged panel analysis to assess the reciprocal relationship over time, these exploratory findings have important implications for future research.

## 6.6 Conclusions

Our findings suggest that caregiver mental health may predict poor weight for age in HIV-infected children and poor child growth and nutrition may negatively impact caregiver mental health. This interrelationship could produce a cycle of negative reinforcement leading to poorer health in both caregivers and their children. This suggests a need for the integration of maternal, and more generally caregiver, mental health care into programs that focus on improving child health and physical development. Further, these findings point to the possibility of preventing poor maternal mental health and later problems in child growth by intervening to



improve child health outcomes early in life. More longitudinal research on the reciprocal effects of maternal mental health and child health and growth is needed to better elucidate their interrelationship and the relative contribution of each factor over time.

**Table 6.1:** Hopkins Symptom Checklist-25 (HSCL-25) measurement model

development\*

Status in measurement model	Item
Items dropped following initial exploratory factor analyses	Feeling low energy, lack of strength (D)
	Blaming yourself for things (D)
	Having no interest in sex (D)
	Headaches (A)
Items dropped following longitudinal confirmatory factor analyses	Shakiness inside (A)
	Suddenly scared for no reason (A)
	Difficulty with sleeping (D)
	Feeling faintness or dizziness (A)
Items retained in scale	Crying easily (D)
	Trouble concentrating (D)
	Poor appetite (D)
	Having no hope (D)
	Feeling sad (D)
	Feeling lonely (D)
	Thoughts of ending your life (D)
	Worrying too much about things (D)
	Feeling no interest in things (D)
	Feeling everything is hard (D)
	Feelings of worthlessness (D)
	Feeling fearful (A)
	Shakiness inside (A)

Heart pounding or racing (A)

Trembling (A)

Feeling tense, you cannot relax (A)

Spells of terror or panic (A)

Feeling restless, can't sit still (A)

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\*D = depression sub-scale; A = anxiety sub-scale

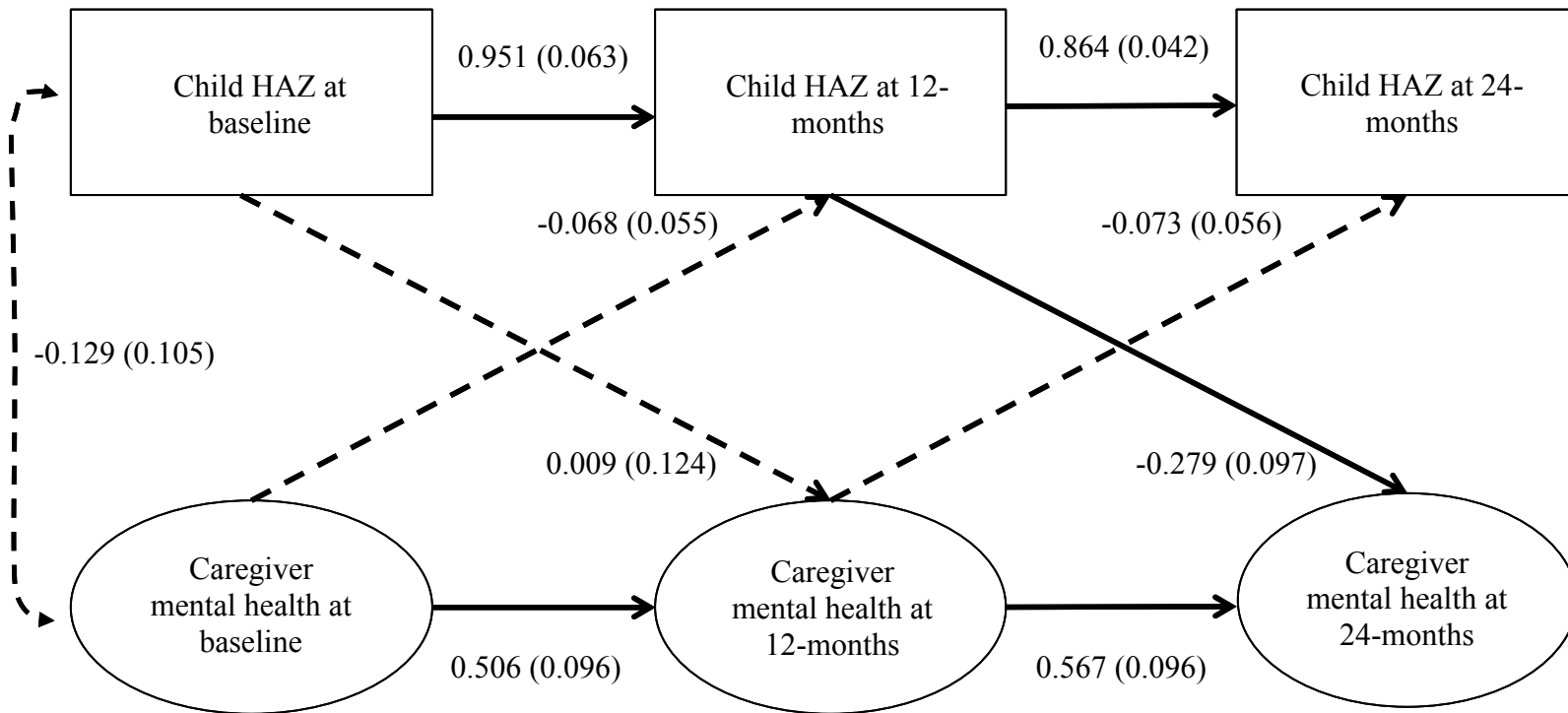
**Table 6.2:** Descriptive statistics of caregiver mental health and child physical health over 2-years of follow-up

	Modified HSCL			Weight for age z-score (WAZ)			Height for age z-score (HAZ)		
	<i>Mean (sd)</i>	<i>Range</i>	<i>n (%)</i>	<i>Mean (sd)</i>	<i>Range</i>	<i>n (%)</i>	<i>Mean (sd)</i>	<i>Range</i>	<i>n (%)</i>
Baseline	0.70 (0.43)	0-2.12	60 (100)	-0.92 (1.51)	-3.87-2.60	60 (100)	-1.29 (1.88)	-4.27-4.25	60 (100)
12-months	0.61 (0.48)	0-2.06	55 (92)	-0.62 (1.23)	-3.00-3.14	53 (88)	-0.59 (1.46)	-3.41-3.10	53 (88)
24-months	0.72 (0.56)	0-2.29	49 (82)	-0.57 (1.16)	-2.77-2.47	53 (88)	-0.68 (1.52)	-4.47-3.37	53 (88)

**Table 6.3** Goodness of fit indices for models with height for age (HAZ) and weight for age (WAZ) z-scores

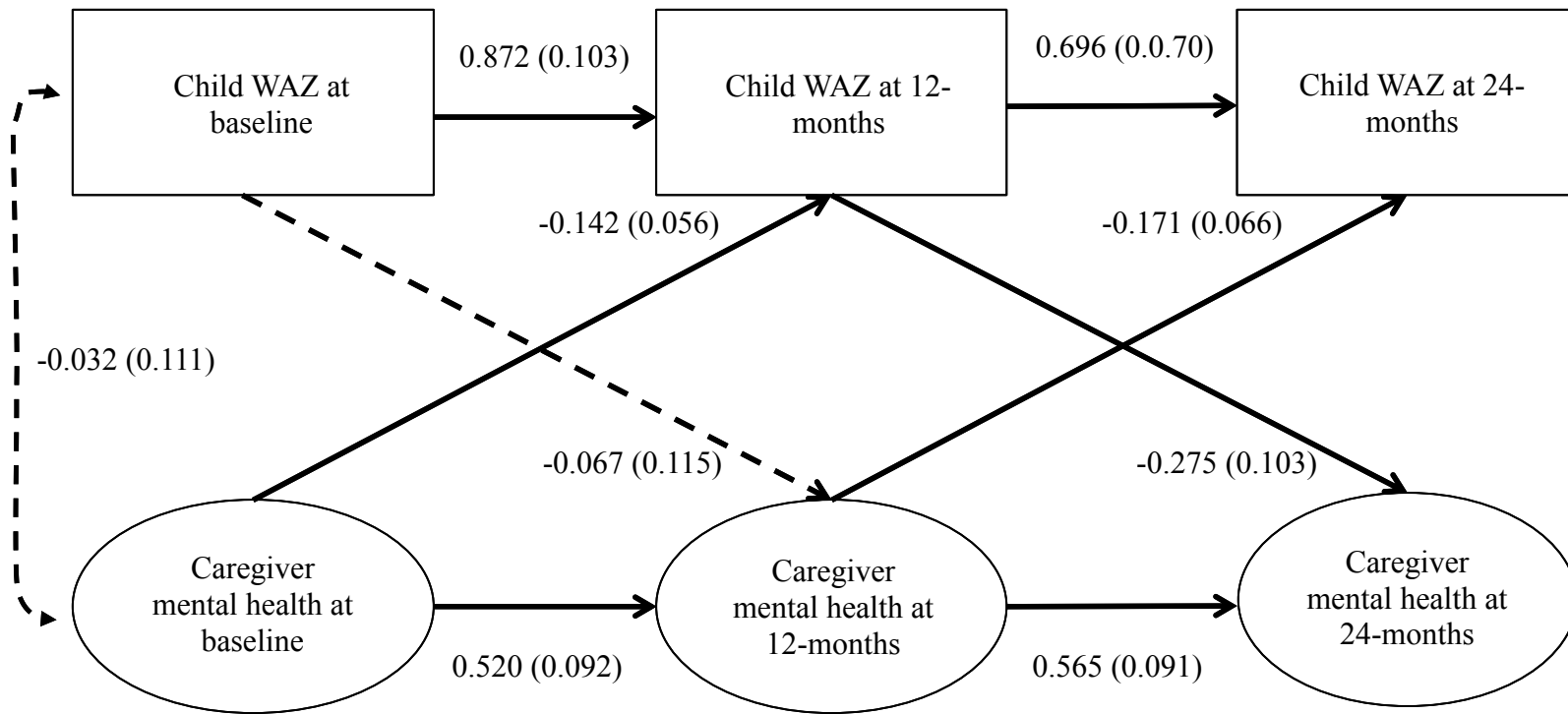
	RMSEA (95% CI)	CFI	TLI	Chi-2 goodness of fit p-value
<b>HAZ model</b>	0.033 (0.008, 0.047)	0.909	0.910	0.0324
<b>WAZ model</b>	0.033 (0.008, 0.047)	0.909	0.910	0.0405

**Figure 6.1:** Interrelationship between caregiver mental health and child height for age z-score (HAZ) over two-years (n=60)\*



\*Not shown in diagram: measurement model, correlation of residuals in structural model, and correlation of residuals in measurement model. Solid line indicates statistically significant path (p<0.05). Estimates are STDYX standardized.

**Figure 6.2:** Interrelationship between caregiver mental health and child weight for age z-score (WAZ) over two-years (n=60)\*



\*Not shown in diagram: measurement model, correlation of residuals in structural model, and correlation of residuals in measurement model. Solid line indicates statistically significant path (p<0.05). Estimates are STDYX standardized.

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## **Chapter 7. Discussion**

The goal of this dissertation was to use data from an ongoing study in Uganda to explore the relationship between the mental health of female caregivers and their HIV-infected children's physical health through a mixed methods approach. Few studies, qualitative or quantitative, have examined this relationship in families affected by HIV in low- and middle-income countries (LMIC), and most studies that have explored this relationship more generally have been cross-sectional. Therefore, this dissertation aimed to:

- 1) longitudinally assess the effect of caregiver mental health (depression and anxiety) on child physical health (growth and HIV-illness severity) among young (aged 2-5 years) HIV-infected children;
- 2) qualitatively explore caregivers' understandings of the relationship between their mental health and their HIV-infected child's well-being; and,
- 3) evaluate the reciprocal relationship between caregiver mental health (depression and anxiety) and child growth in HIV-infected children over time.

The findings for each of these aims were presented in Chapters 4-6 of this dissertation. The purpose of this chapter is to synthesize these empirical findings and explore implications for future research and practice.

## 7.1 Summary of findings

Malnutrition and poor growth were prevalent in this sample of HIV-infected children from rural Uganda; a third of the children were stunted and a quarter underweight at the beginning of data collection. Though the overall mean score for combined depression and anxiety among caregivers at baseline fell below a cut-off validated in a similar population (approximately 1) for clinical significance (1), almost 40% of caregivers reported symptoms in the clinically significant range during at least half of study assessments. These levels of caregiver distress (2–4) and poor growth and nutritional status (5–8) are consistent with previous literature on HIV-affected families and indicate the relevance of conducting research on their interrelationship to this population.

While prior research suggests that maternal depression may double the odds of stunting and wasting in children (9), results from this dissertation do not clearly indicate that the same is true in a sample of HIV-affected families from sub-Saharan Africa. An increase in caregiver depression and anxiety symptoms over time did not result in poorer child growth or more severe HIV-illness in the child as was hypothesized, though higher baseline caregiver symptoms did predict higher viral load in children in this sample over time. While associations did not reach statistical significance, children of chronically symptomatic caregivers had, on average, lower weight for age and height for age z-scores at the end of follow-up, as compared with children of mothers with episodic or consistently low symptoms. These findings are consistent with a recent study of HIV-

affected families in eastern Africa that found no association between prenatal depression and child stunting or underweight but a small effect of cumulative maternal depression on these outcomes (1). A possible explanation is that among families affected by HIV, the socioeconomic and biological aspects of the disease are so dominant in their influence on child health outcomes that independent effects of caregiver mental health are overshadowed.

The cross-lagged panel analyses of the longitudinal data also suggested that caregiver mental health did not have a meaningful association with child height for age over time. However, in these analyses, higher caregiver symptoms were associated with decreases in weight for age, contrary to findings in Aim 1 regression analyses. The difference in findings may be due to how symptoms were modeled, as in cross lagged analyses symptoms from a year prior were examined for how they predicted child health at each time point. Simultaneous modeling of cross-sectional and reciprocal associations in the cross-lagged panel analysis may have better parsed out the effects by time and directionality. These apparent contradictions in findings suggest that timing and chronicity may be important factors to consider in understanding how caregiver mental health problems may have negative effects on child physical health.

Qualitatively, caregivers described their mental health as affecting their children, with the effects often understood as more social or emotional rather than physical in nature. For instance, children were said to express worry at seeing their caregiver unhappy and would not want to play with friends as a result. Caregivers also mentioned

that children might refuse to eat in these circumstances. Distress (i.e. generalized mental health problems) was seen as impeding caregivers' ability to earn money or provide for their children. Importantly, this inability to provide due to distress, sickness, or poverty was a source of great worry and sadness for caregivers. Caregivers described struggling to get appropriate treatment for sick children, which created additional worry and pressure in situations where caregivers already feared for their child's well-being or even survival. Quantitative analyses from Aim 3 found empirical support for a link between child growth at 12-months and caregiver mental health at 24-months: caregivers of children with higher HAZ and WAZ scores (i.e. having better growth) experienced less distress than caregivers of children with lower HAZ and WAZ scores, suggesting that child thriving may have a positive influence on caregiver mental health.

In qualitative interviews, family was described as a potential source of emotional and tangible support for children, but also a source of conflict and stigma. This suggests that looking at the relationship of caregiver mental health and child physical health as unidirectional is only providing insight on part of a more complicated process that is embedded in both a context of poverty and stigma as well as one of great resilience. This also points to the importance of using mixed-methods approaches to understand complex social phenomena that this study sought to explore.

## 7.2 Limitations

Several limitations should be considered when interpreting the findings of this dissertation. Most importantly, this research primarily consisted of secondary data analysis. Thus, the study from which the quantitative data were drawn was not originally designed to meet the goal of this dissertation. The small available sample size meant that statistical power was a concern in some analyses, which should be interpreted as exploratory where indicated in this dissertation. In addition, making multiple comparisons heightens the probability of making a type-I error. While there was also no reliability sub-study for the variables included in this dissertation, the structure and internal consistency of the caregiver mental health scale was assessed post-hoc. Data were not collected on some potentially important contextual factors (such as gender-based violence) and possible important mechanisms (such as attachment). Further, we did not have information on caregiver symptoms of depression and anxiety in the prenatal or infant period nor did we have information on children's growth from birth as data were only collected once a caregiver-child dyad entered the study when the children were between the ages of 2 and 5 years.

As the data were drawn from the treatment as usual control arm of a trial in which caregivers were receiving health and nutrition education, this study cannot be generalized to how caregiver mental health may impact child growth in the general population of HIV-affected families. While these findings may not be generalizable to non-help seeking populations or women not connected to health services, women were able to receive

some benefit from their participation in this study, which increased its ethical acceptability. Further, this study does suggest women and their children can continue to face substantial health concerns even when receiving standard care.

For the qualitative data collected as a part of this dissertation research, the time available to conduct the interviews limited opportunities for iteration. As we did not audio record interviews and interviewers were limited in their ability to write quickly in the local language, transcripts may also have been incomplete. These factors, along with the fact that often women were tired during interviews due to their busy lives, limited the richness of the data collected. As women were participating in a larger trial, they may have been reluctant to share information with interviewers that they felt would negatively impact their training or relationship with the local implementing partner organization. To minimize this bias, individuals not affiliated with the parent trial were hired as interviewers.

### 7.3 Directions for future research

Results from the three studies contained in this dissertation suggest that there is a complex and intergenerational relationship between mental health and physical health in families affected by HIV. A strength of this dissertation is the use of longitudinal data, as the directionality of the relationship between maternal mental health and child growth can only be observed and tested in longitudinal studies. A limitation of existing research is that the majority has been cross-sectional (9) limiting our ability to assess causality. The

findings based on both qualitative and quantitative data that child sickness and poor growth may impact caregiver mental health is deserving of further inquiry in both HIV-affected and non-affected families.

In this dissertation, mediators and moderators of the relationship between caregiver mental health and child growth could not be assessed. This was in part due to a limited sample size, but also a lack of substantial effects found in regression analyses. It is important that future studies on this topic not only be longitudinal, but powered to begin to examine mechanisms and effect modifiers of this relationship. The qualitative findings of this dissertation point to several potential variables to consider including stigma, family illness, isolation, and poverty, all of which may exacerbate the effects of caregiver distress on child health. Conversely, emotional and instrumental support from family and community may be protective. Women themselves may engage in helpful coping strategies such as religious activities that also warrant investigation.

A potential reason that this study found mixed results related to the impact of caregiver mental health on child growth is that the sample of children was aged 2-5 years at first assessment while the majority of studies on this topic have been conducted with infants or children under the age of two years (9). Although the period from two years to middle childhood can be a critical time for catching up on growth (22), it is possible that the effects of caregiver depression and anxiety on child growth are attenuated in this developmental period in which children are less vulnerable to morbidity and mortality.

Given varying sensitivity and plasticity in developmental course across life stages, child age is another moderator to be examined in future research (10).

While children who are uninfected but exposed in utero to HIV have also been shown to be at increased risk of poor growth (6,11), caregivers of HIV-infected children are potentially more at risk of depression and anxiety (12,13). The relationship between these constructs may or may not be the same when children are HIV-exposed as opposed to HIV-infected; thus, HIV-status of the child should also be investigated as a moderator.

Several mediators of the effect of caregiver mental health on child growth and nutrition have been explored in prior studies though because most studies have been cross-sectional, these explorations could not be conclusive. The mediators have included maternal functional impairment (9,10), reduced stimulation in a child's environment (11), early cessation of breastfeeding (12), and poor mother-child attachment (13,14). Qualitative findings from this dissertation point to the need to assess attachment and caregiver functional impairment (and any associated loss of assets or income) as mechanisms of the relationship. Adherence to HIV treatment may mediate the effect found of caregiver mental distress on child viral load. In Uganda, two studies have found an association between worse ART adherence and depression in adults (14,15). As caregivers are primarily responsible for medication administration to young children, the effect of depression could extend to child adherence as well. Feelings of self-efficacy, control, and empowerment should be explored as potential mediators of the reciprocal effect of poor child health on caregiver mental health based on the qualitative findings.



Researchers conducting future investigations on this topic should consider a mixed-methods design; the inclusion of qualitative data allowed for hypothesis generation as well as exploration of the relationships identified in the quantitative analyses. The qualitative findings also point to a need for more research that goes beyond measuring depressive symptoms (which is the standard when exploring maternal mental health) and take a broader look at maternal mental health more generally. The measures used in this dissertation research included anxiety symptoms as a step in that direction, though other disorders could be added as relevant to local populations (i.e. posttraumatic stress symptoms).

#### 7.4 Implications for public health policy and practice

Globally, the provision of mental health services as a part of maternal and child health care is rare, likely in part due to misinformation about the ability of health workers to deliver effective interventions, thoughts that integration is not possible, and a feeling that maternal mental health is not an important aspect of ensuring child well-being (16). Results of this dissertation support the existing call for integration of screening and treatment for mental disorders into maternal and child care (17) by demonstrating the relevance of maternal mental health and child health to one another.

The fact that a substantial proportion of women reported elevated symptoms at multiple time points in this study also reiterates calls for a stepped-care approach to mental health promotion and treatment of distress among mothers in LMIC (18).

Increasingly, evidence demonstrates the strengths and feasibility of a stepped care approach to improving the mental health of mothers in LMIC. For identification, depression screening has previously been successfully integrated into antenatal care in a sub-Saharan African setting with a high prevalence of HIV (19). While home visitation programs for new mothers have in general been shown to be ineffective in reducing depression symptoms (20), these kinds of services may hold promise for promoting positive mental health or preventing distress in at risk women in a stepped-care model. Parenting programs have shown some evidence of reducing symptoms of depression and anxiety and of promoting healthy attachment as well (21,22). For women who are experiencing severe or chronic symptoms, review of available evidence on the effectiveness of interventions for depression also indicates that treatment programs are feasible and effective in LMIC settings (17) and a separate review shows that these types of interventions can be successfully implemented by non-specialist health care workers (23).

One potential pathway by which integration of mental health services could have a beneficial impact on women and children is by increasing care received by pregnant and recently post-partum women. Women experiencing depression are less likely to attend antenatal care (24,25). According to Uganda's 2011 Demographic and Health Survey, while 95% of pregnant women receive one antenatal care visit, less than half attend the recommended minimum of four visits and only one-third receive a postnatal check-up (26). Antenatal care is especially important for HIV-infected women, over 25%

of whom are estimated to not receive prevention of mother to child transmission in Uganda (27). By integrating mental health care in the perinatal care system, attendance at antenatal care sessions may be increased for those women for whom depression is inhibiting service use.

Undernutrition during early childhood is prevalent in low-income countries like Uganda, especially in the context of HIV. Given the long-term impacts that undernutrition can have on child health and development, our findings that there may be a reinforcing relationship between caregiver symptoms of depression and anxiety and child health outside the well-studied period of infancy are of critical public health relevance. Through further research on this topic and investigation of the possible positive effects of integration of maternal mental health services into health services for pregnant women and children including the expansion of ART provision, there is promise for early intervention to improve the quality of life of families affected by HIV in low-income countries.

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# Curriculum Vitae

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## Personal information

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Birthdate: September 27<sup>th</sup>, 1983  
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## Education

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**JOHNS HOPKINS BLOOMBERG SCHOOL OF PUBLIC HEALTH, Baltimore, MD** **2015**  
Doctor of Philosophy in Public Health, Mental Health Department. Advisor: Judith K. Bass

**JOHNS HOPKINS BLOOMBERG SCHOOL OF PUBLIC HEALTH, Baltimore, MD** **2011**  
Masters of Science in Public Health, International Health Department

**THE COLLEGE OF WILLIAM AND MARY, Williamsburg, Virginia** **2006**  
Bachelor of Arts in Government and African Studies

**THE SCHOOL FOR INTERNATIONAL TRAINING, Durban, South Africa** **2005**  
“Reconciliation and Development” Study Abroad Program

## External Funding

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**NATIONAL INSTITUTE OF MENTAL HEALTH** **2012-2015**  
**F31MH099959 (Murray, PI)**  
**\$127,140 (100%)**  
*Caregiver Mental Health and Child Physical Health in HIV-Affected Families*

**URBAN HEALTH INSTITUTE, Johns Hopkins Bloomberg School of Public Health** **2013**  
**Co-awardee/investigator**  
**\$5,000**  
*Process Evaluation of a Refugee Mental Health Screening Program*

## Professional experience

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**JOHNS HOPKINS BLOOMBERG SCHOOL OF PUBLIC HEALTH, Baltimore, MD** **2011-2015**  
**Research Assistant**

- Conduct data management and analysis for two trials of interventions for survivors of sexual assault in eastern Congo and a trial of psychosocial support in Kurdistan
- Assist with writing of grants and scientific articles
- Build capacity of local research staff to manage and analyze data for a trial of a parenting skills intervention in Uganda

**INTERNATIONAL RESCUE COMMITTEE, New York, NY** **2014**  
**Research Assistant**

- Short term consultancy assessing moderation of the effect of a microfinance program on mental health and economic outcomes among survivors of sexual violence
- Created an analytic plan, conducted analyses, and assisted in report writing for donor

**GLOBAL HEALTH ACCESS PROGRAM, Mae Sot, Thailand** **2010 – 2011**  
**Child Health and Trauma Management Fellow**

- Responsible for building the capacity of four coordinators from a local ethnic health department to administer evidence-based public health interventions to improve child health and effectively manage traumatic injuries in conflict areas of Eastern Burma
- Assisted with donor reporting, grant management, and budgeting
- Conducted formative qualitative research as a part of the completion of a public health Master's degree on care-seeking behavior for childhood pneumonia

**INTERNATIONAL RESCUE COMMITTEE, Charlottesville, VA** **2008- 2009**  
**Employment Coordinator**

- Assisted over 100 refugees from more than 10 countries in securing employment, developing long term career goals, creating household budgets and reaching self sufficiency
- Administered a welfare avoidance employment program for refugee clients
- Trained and supervised 6 employment interns and managed a caseload of up to 70 people

**AmeriCorps/VISTA Integration Coordinator** **2006 –2008**

- Developed and taught a 16 unit job readiness curriculum to help prepare newly resettled refugees for the American job search and workplace expectations
- Taught financial literacy, conducted homebuyer education, assisted in career counseling, and promoted asset development for refugees living in the U.S. from 6 months to 5 years
- Created and administered a scholarship program that enabled 15 refugees to pursue higher education or career development courses
- Originated and ran a summer youth employment program

**Teaching Experience**

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**FORMATIVE RESEARCH FOR BEHAVIORAL AND COMMUNITY INTERVENTIONS** **2013-2015**  
**Teaching assistant**

**PSYCHIATRIC EPIDEMIOLOGY** **2014**  
**Teaching assistant**

**STATISTICS IN PSYCHOSOCIAL RESEARCH** **2014**  
**Teaching assistant**

**RESEARCH ETHICS AND INTEGRITY- US AND INTERNATIONAL ISSUES** **2013**  
**Teaching assistant**

**Awards, Fellowships and Honors**

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2013 Sommer Scholar, Johns Hopkins Bloomberg School of Public Health  
2012 Marcia G. Pines Award in Bioethics and Public Health

- 2010 Humanitarian Assistance Scholarship, Johns Hopkins Bloomberg School of Public Health, Department of International Health
- 2006 *Summa Cum Laude*, The College of William and Mary
- 2006 Megan Owen Award for Excellence in Government, The College of William and Mary
- 2006 Omicron Delta Kappa, The College of William and Mary
- 2006 Phi Beta Kappa, The College of William and Mary
- 2002 Monroe Scholar, The College of William and Mary

## Publications

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### ARTICLES

#### *Peer Reviewed*

**Murray, S.M.**, Robinette, K., Bolton, P., Cetinoglu, T., Murray, L.K., Annan, J., Bass, J.K. Stigma among survivors of sexual violence in Congo: Scale development and psychometrics (In press). *Journal of Interpersonal Violence*.

Burkey, M, **Murray, SM**, Bangirana, P, Familiar, I, Opoka, RO, Nakasujja, N, Boivin, M, Bass J. Executive function and attention-deficit/hyperactivity disorder in Ugandan children with perinatal HIV exposure. *Global Mental Health*. 2015; 2(e4)

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Doocy, S., Daniels, A., **Murray, S.**, & Kirsch, T. (2013). The Human Impacts of Flood: a Historical Review of Events 1980- 2009 and Systematic Literature Review. *PLOS Currents Disasters*. Edition 1. doi: 10.1371/currents.dis.f4deb457904936b07c09daa98ee8171a.

#### *Under Review*

Weiss, W., Murray, L., Zangarana, G., Mahmooth, Z., Kaysetn, D., Dorsey, S., Lindgren, K., Gross, A., **Murray, SM**, Bass, J., Bolton, P. Community-based mental health treatments for survivors of torture and militant attacks in Southern Iraq: a randomized control trial. Under review at *BMC Psychiatry*.

**Murray, S.M.**, Kass, N, Mendelson, T., Bass, J.K. The ethics of Global Mental Health Survey Research in

Low- and Middle-Income Countries. Under review at Global Mental Health.

#### CONFERENCE POSTERS AND PRESENTATIONS

Burkey, M., **Murray, SM.**, Opoka, R., Boivin, M., Bass, J. (October 2014) Gender and ADHD in Ugandan Children: Comparison of Symptoms, Factor Structure, Prevalence, and Executive Functioning. 61<sup>st</sup> Meeting of American Academy of Child and Adolescent Psychiatry. San Diego, CA.

Burkey, M., **Murray, SM.**, Andersen, A., Horwitz, R. (October 2014) Public Perceptions of Mental Illness and Violence: Data from 7 Trillion Internet Queries, 2004-2014. 61<sup>st</sup> Meeting of American Academy of Child and Adolescent Psychiatry. San Diego, CA.

**Murray, S.**, Kane, J., Bass, J., Mohammed, T., Murray, L., Bolton, B. (November 2013). The modifying role of coping strategies on a mental health intervention among survivors of torture in Kurdistan, Iraq. Poster presentation at the American Public Health Association Annual Meeting: Boston, MA.

**Murray, S.**, Hall, B., Canetti, D., Galea, S., Hobfoll, S. (November 7<sup>th</sup>, 2013). The role of social resources in the prediction of incident PTSD within the Palestinian Authority. Oral presentation at the International Society of Traumatic Stress Studies Annual Meeting: Philadelphia, PA.

Annan, J., Robinette, K., Greco, D., Seban, J., **Murray, S.**, Hall, B., Bolton, P., Bass, J., (November 2013) Impact of Village Savings and Loans Associations on Improving Mental Health and Well-Being among Sexual Violence Survivors in South Kivu, DRC: Results from a Randomized Controlled Trial. In Bass, J. (chair) Improving Resiliency and Mental Health of Sexual Violence Survivors in Low-Income Conflict-affected Contexts in Sub-Saharan African through Economic Programming. Symposium at the 29th Annual Meeting of the International Society for Traumatic Stress Studies, Philadelphia, PA.

Bass, J., Annan, J., Robinette, K., Greco, D., Kaysen, D., Hall, B., **Murray, S.**, Seban, J., Bolton, P. (November 2013) Combining Mental Health and Social Economic Programming to Improve Resiliency, Mental Health and Economic Outcomes for Sexual Violence Survivors in South Kivu, Democratic Republic of Congo. In Bass, J. (chair) Improving Resiliency and Mental Health of Sexual Violence Survivors in Low-Income Conflict-affected Contexts in Sub-Saharan African through Economic Programming. Symposium at the 29th Annual Meeting of the International Society for Traumatic Stress Studies, Philadelphia, PA.

Boivin, M., Bass, J., **Murray, S.**, Paige, C., Shohet, C., Givon, D., Bangirana, P., Opoka, R., Nakasujja, N., Klein, P. (April 2013). A Year-long Caregiver Training Program to Improve Neurocognition in Ugandan Children Affected by HIV. Oral presentation at the Society for Research in Child Development Annual Meeting; Seattle, WA.

Bass, J., **Murray, S.**, Annan, J., Kaysen, D., Griffiths, S., Jinor, J., Murray, L., Bolton, P. (November 2012). Using Cognitive Processing Therapy (CPT) to Heal the Mind: Results From a Randomized Controlled Trial for Sexual Violence Survivors in South Kivu, Democratic Republic of Congo. In Bass, J. (chair). Meeting the Mental Health Needs of Sexual Violence Survivors in the Democratic Republic of Congo: Analyses From a Randomized Controlled Trial of Group Cognitive Processing Therapy. Symposium at the 28th Annual Meeting of the International Society for Traumatic Stress Studies, Los Angeles, CA.